APRIL
1962

PRICE 75 CENTS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

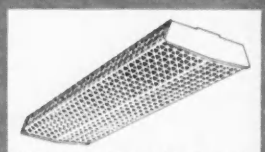
WITH ELECTRICAL CONTRACTING

Roundup of practical techniques in Chicago shops, hosts to EASA Convention, June 10-13.
page 75.

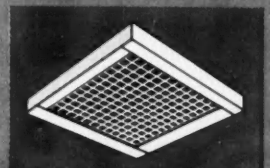
Electronics plant electrical distribution is designed for doubling present utilization. Systems include photocell lighting control and electrostatic air cleaning. page 80.

A McGRAW-HILL PUBLICATION | 61ST YEAR

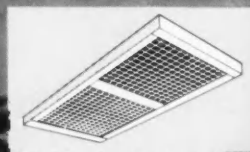
Air-Handling Troffers based on "Aspiration" principle; in 1′ x 4′ and 2′ x 4′ modules.



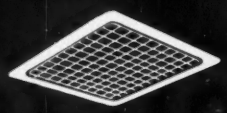
"Prismaround" **Air-Conditioned** units with improved Prismoid Gratelite**. Only wrap-around design for long life ballast operation.



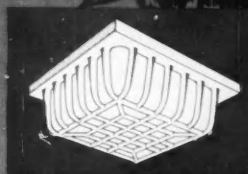
Single Square-Panel lamp for Surface or Suspended mounting. Features trouble-free installation.

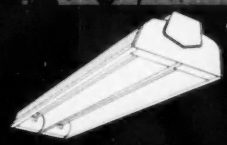


Double Square-Panel lamp unit for surface or drop mounting, lends itself to modular patterns and designs.



Square-Panel **recessed** fixture featuring the world-famous Gratelite Louver Diffuser*.





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The Edwin F. Guth Company presents seven dramatically new lighting fixtures, each one demonstrating an exciting advance in the science of lighting. We proudly designate this special collection of fixtures as our **Anniversary Line** in commemoration of 60 years of service to the industry. On this, our **Sixtieth Anniversary**, we cordially welcome you to the wonderful new world of lighting!

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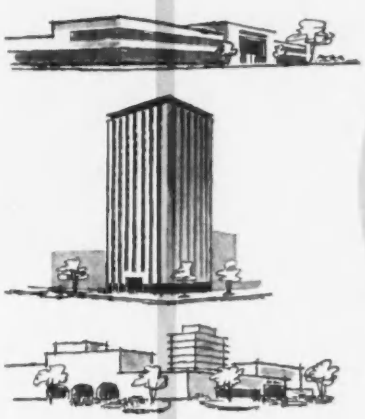

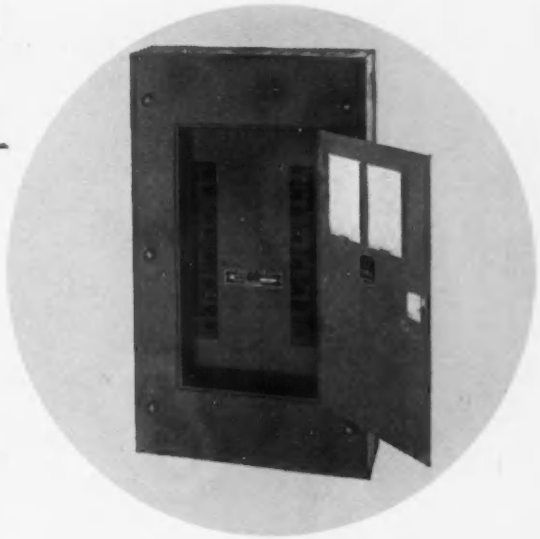

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Availability is always an important factor—and here Square D rates especially high. Regional manufacturing and assembly facilities for "specials," combined with a national network of stocking distributors for standard panels, provide exceptional delivery and service.

write for Bulletin SD-126. It tells the quality story in detail
Square D Company, Mercer Road, Lexington, Kentucky

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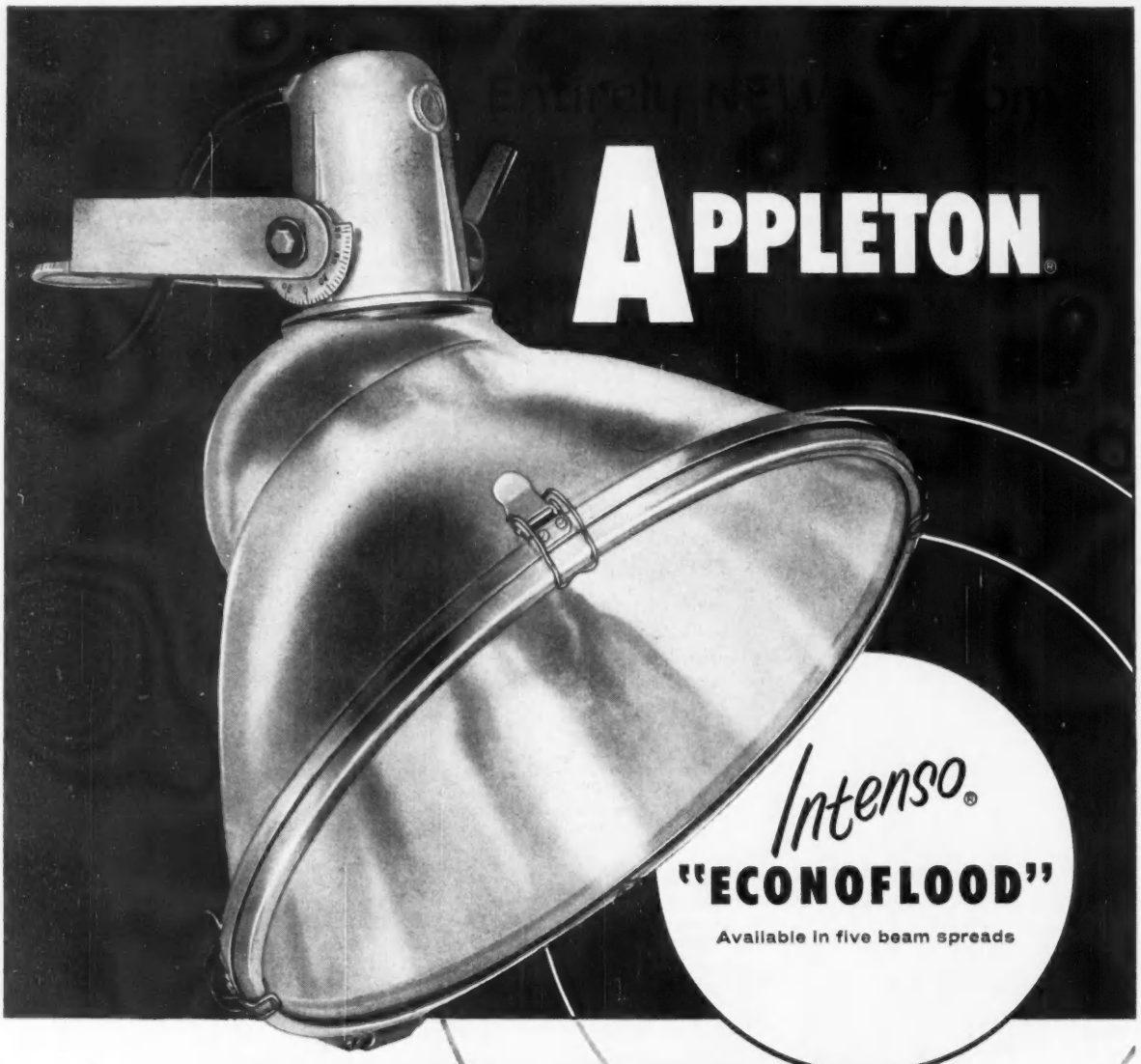

Feature for feature, Dollar for Dollar, "Econoflood" Floodlight is a Tremendous Buy!

- **Built-on locking wrench permits reversing fixture for easy relamping. Fixture snaps back into preset position when turned forward.**
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- **Completely weatherproofed!**
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"Econoflood" is intensely brilliant because an exclusive, self-centering inner reflector augments the primary Alzak* reflector. Has positive, locked-in precision aiming, 180° horizontal and vertical scales. It's a new high in floodlight efficiency . . . a product of Appleton's new Lighting Laboratory.

Easy, flexible installation; versatile, interchangeable accessories. Parts of quality stainless steel and pressure cast aluminum. Five efficient beam spreads cover all requirements, including plant security, sports areas, billboards and parking-shopping centers.

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with which is consolidated Electrical Contracting The Electragist and Electrical Record — Established 1901

Published for electrical contractors, electrical departments in industry, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management in the field of electrical construction and maintenance.

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Chicago Apparatus Service Shop Features 75

A sampling of what motor repair specialists will see when they visit Chicago shops during the 1962 EASA Convention in June.

Distribution Designed for Plant Expansion 80

A western electronics firm with 10-year 15-fold expansion rate occupies modern plant where electrical facilities in modern $4\frac{1}{2}$-million 4-building complex are designed for double present capacities.

Testing Conductive Flooring 85

Effective application of electrically conductive floors for preventing static spark hazards in combustible atmospheres demands periodic testing to assure maintenance of required values of conductivity.

Plus Electrical Home Values 88

Located in New York's Catskill mountain country, a new all-electric home surpasses Gold Medallion requirements and incorporates a 400-amp service to power a wide range of electrical extras.

A Detailed Study on Minimizing Transformer Noise 90

By F. J. BRUTT and A. A. MOOSALLY—Here's important data for designers and constructors on the problem of minimizing hum from dry-type transformers installed indoors where noise intrusion on quiet areas would be objectionable.

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By RAY ASHLEY—How to allocate estimating time—Part 1

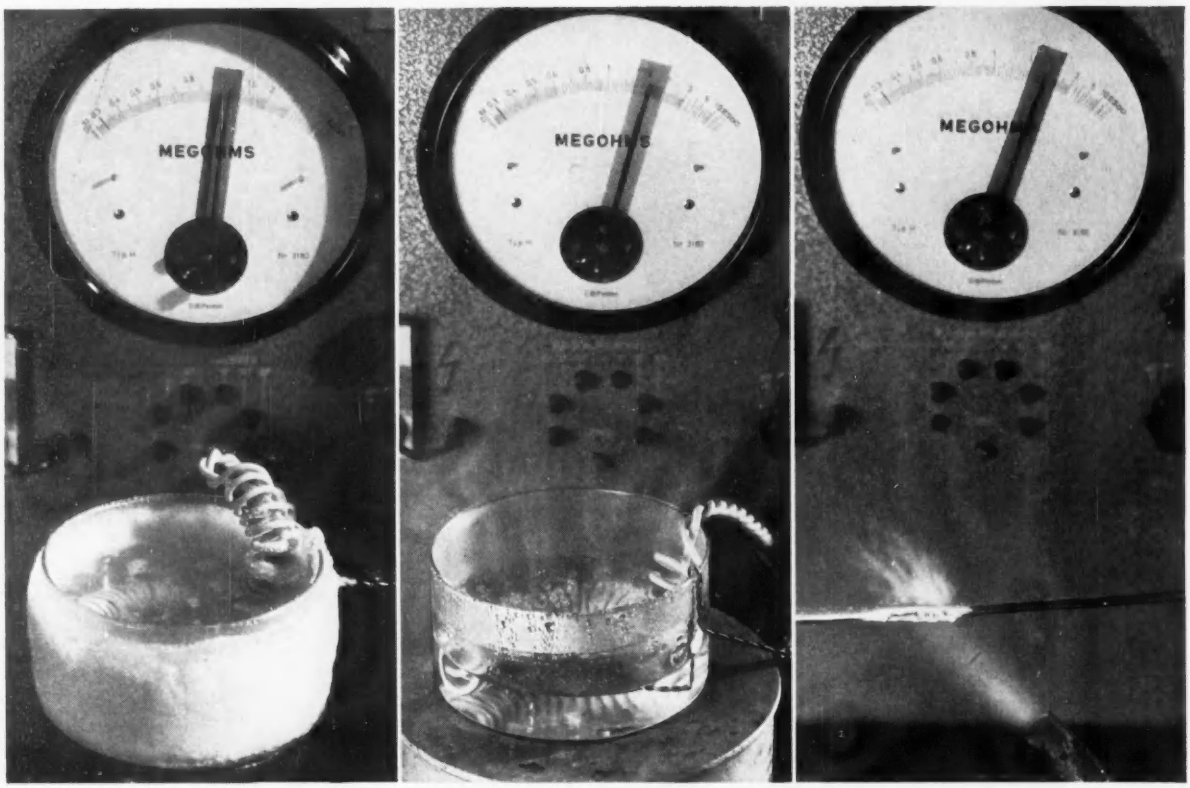
Electric Heat for High School 96

By R. J. LAWRIE—Design, application and installation details for a large, modern all-electric high school using over 1500 kw of various types of space heating equipment.

MORE

SILICONE NEWS from Dow Corning

Frozen...boiled...burned

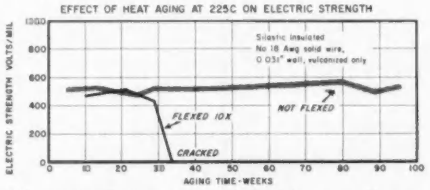


Silastic insulation maintains its properties from −90 to 500 F.

When mercury freezes, Silastic®, the Dow Corning silicone rubber, is still flexible. Fact is, Silastic insulation is ideal for temperatures as low as −90 F . . . easily withstands sleet, snow, ice and adverse weather you'd expect to find in the polar regions.

In a hot stew? Specify Silastic! Even 500 F has little effect on the properties of Silastic. That's why many industrial plants use Silastic insulated wire and cable. Strip mills, rolling mills, and metal forming plants (where high temperatures, humidity, chemical splash and fumes are common environments) are but a few of the installations using the properties of Silastic to provide cable dependability and long life.

To air-condition Hades would be a rugged assignment. However, if you were engineering the job you should specify power cables insulated with Silastic. Even if the Silastic burns, the ash is nonconductive. The line can carry a normal load as long as the ash remains intact and dry. This unique property of Silastic has been of primary importance in the protection of vital communication centers in both Navy shipboard and commercial installations.



Silastic insulation retains dielectric strength over a wide temperature span. What's more, its electrical properties are extremely stable and survive relatively unchanged even after long storage, weathering, thermal aging or heat cycling.

Write Dow Corning Corporation, Midland, Michigan, Dept. 3604, for a list of wire and cable manufacturers who use Silastic.

first in silicones

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

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Questions on the Code **156**

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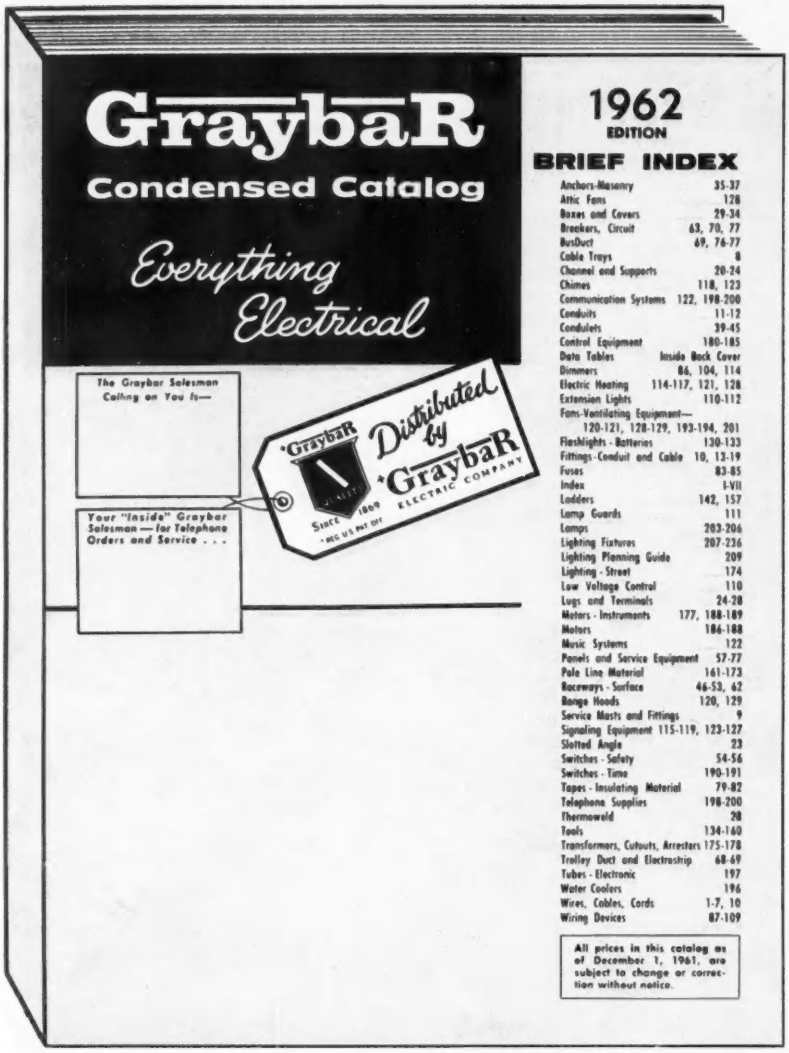

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Sidelights

NEW BINDING

Some of our observant readers may have noticed that our March issue handled differently from previous issues. There were no wire staples in the margin. When the magazine is opened the pages lay flat. This results from a new binding process, called "perfect binding," which we tested on our May 1961 issue and subsequently adopted for all issues beginning last month. The usual fold of the forms is trimmed off and the edges of the individual pages are attached with a strong adhesive to the back-strap. With no side wires the pages open wide in the gutter and lay flat.

In previous issues some forms in the Reader Service section were specially perforated to permit convenient removal of individual pages. This is no longer necessary since, with the new binding process, any page can be readily removed, without disturbing the rest of the book, by flattening the gutter and tearing the page off along its adhesive attachment.

RESIDENTIAL ELECTRIC HEATING

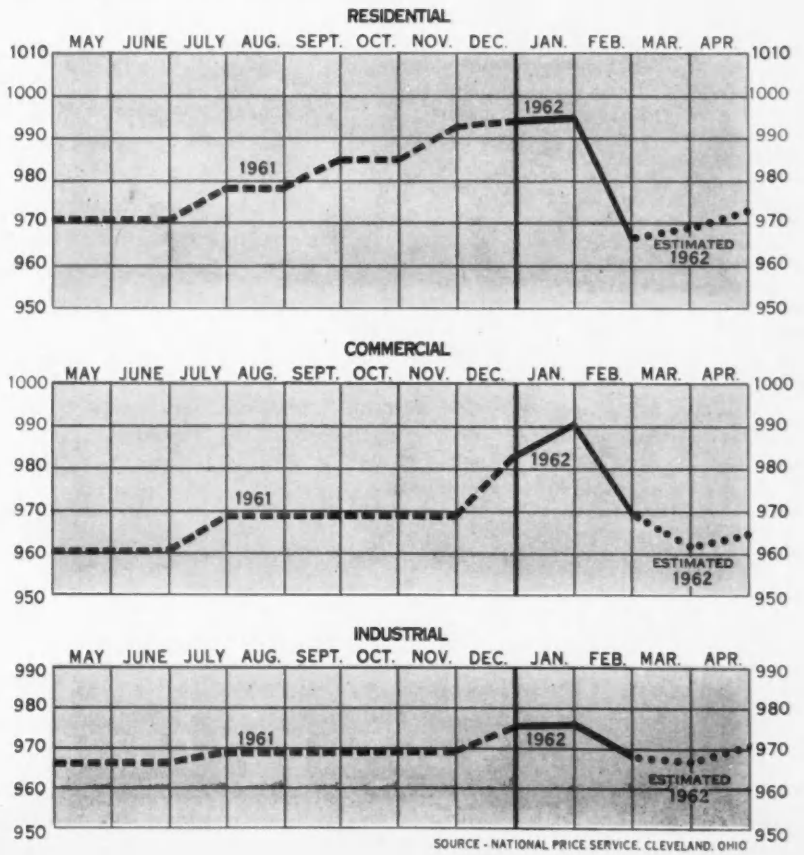
A limited number of overruns of "1962 Residential Electric Comfort Heating," as originally printed for the March issue are still available. This special report discusses modern methods for heat loss calculations and estimating operating costs. While specially prepared to provide the engineer and contractor actively engaged in electric heat design and installation with precise current practice, it is also ideal for the classroom or home study. Comprehensive tables and charts greatly simplify heat loss calculations. Copies are available at 40 cents each. Quantity prices will be quoted on request.

ELECTRICAL MATERIALS COST INDEX

CHANGES IN THE COST OF ELECTRICAL MATERIALS FOR EACH OF THREE TYPICAL JOBS ARE SHOWN ON THESE THREE CHARTS.

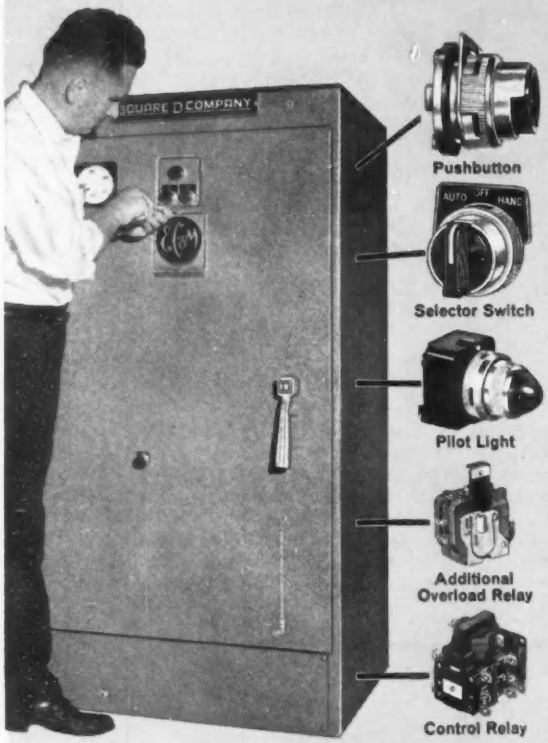
THE BASE (1000) REPRESENTS THE AVERAGE COST OF THE MATERIALS FOR THE YEAR 1960

THE MONTHLY INDEX POINTS SHOW THE VARIATIONS IN COST ON THE FIRST OF EACH MONTH.



SOURCE - NATIONAL PRICE SERVICE, CLEVELAND, OHIO

FAST DELIVERY of SIZE 6, 7 & 8 STARTERS



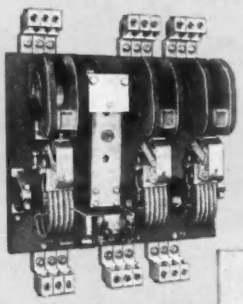
PRE-ENGINEERED MODIFICATIONS eliminate Special Engineering

Square D NEMA Size 6, 7 and 8 magnetic starters are now built with a plate in the door to accommodate modifications when needed. The same modifications which have long been available on Square D starters through Size 5—pushbuttons, selector switches, pilot lights, additional overload relays, auxiliary contacts—can now be added to the larger starters without special engineering.

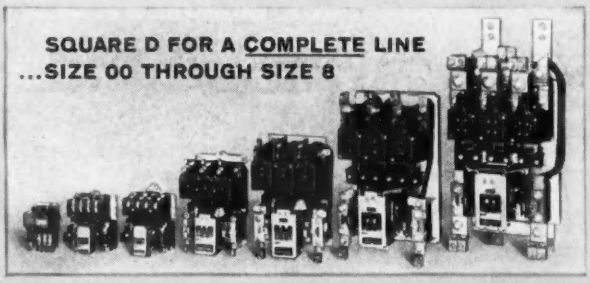
This means fast processing of your order, quick delivery of your starters. What's more, you can make the same modifications in the field. The wiring diagram shipped with each starter shows exactly how to do it.

Available in ratings up to 900 hp, Square D Size 6, 7 and 8 starters can be ordered as open devices, or in general purpose, dust-tight and water-tight enclosures.

• With Square D Size 6, 7 and 8 starters, you get DC-operated (self-contained DC supply) mill-type contactors—at no extra cost. Exclusive Line-Arc construction dissipates heat, provides longer contact life. Self-lubricating bearings plus simple design make maintenance extremely easy. Another standard feature is lugs which accommodate either copper or aluminum cable.



• The magnetic starters shown at right—which range from Size 00 through Size 5—plus the Size 6, 7 and 8 starters described above, add up to a *complete* Square D line for *any* AC motor application.



Write for Bulletin 8536. Square D Company, EC&M Division, 4500 Lee Road, Cleveland 28, Ohio

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EC&M DIVISION • CLEVELAND 28, OHIO

wherever electricity is distributed and controlled

5291

Washington Report

APRIL • 1962

The new construction spending rate fell 1.5% in February from the January rate, to $58.7 billion seasonally-adjusted annual rate. This rate was the lowest since last August, but was still 5% higher than outlays in February 1961. Census Bureau officials point out that this decline in total construction spending coincides with a recent decline of new residential housing starts.

Privately financed new construction in February was $2.8 billion, while publicly financed construction totaled $1.1 billion. Residential construction accounts for about 35% of this $3.9 billion total.

Housing starts in February declined 11% from January, for the fourth month in a row. The seasonally-adjusted annual rate was 1,126,000 units, the lowest rate in 14 months, which compares with the 1961 high annual rate of 1,434,000 units reached last October. The actual starts in February were 74,300, down 7% from January and 2% below February 1961 starts. Many housing officials now doubt that the 1.4 million new starts forecast earlier for 1962 will be realized.

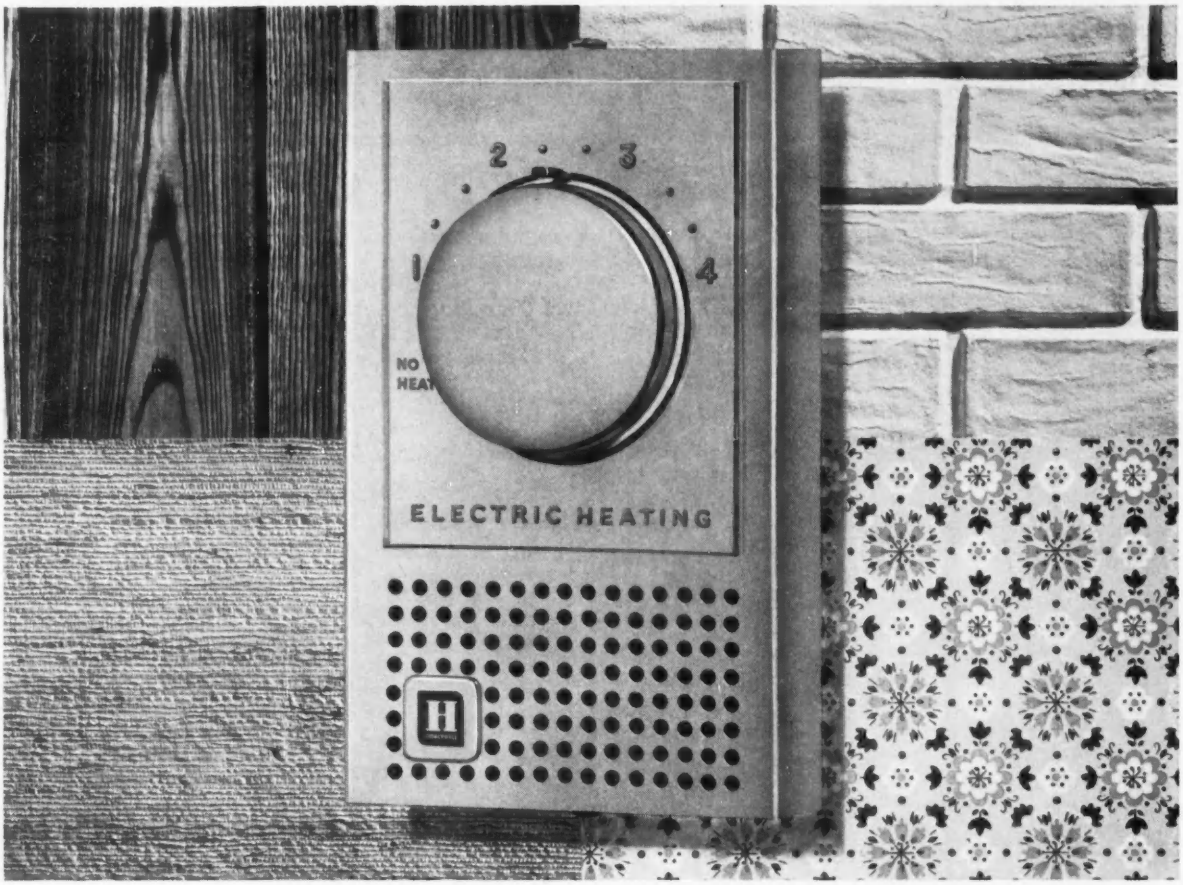
Construction of one-family houses has declined about 40% since 1950, when about 1.5 million single-family residences were built. In the period between 1955 and 1961, the percentage of apartment house (multi-family) housing units has increased from 8.4% to 26.3%, or over 300%.

Capital outlays on new plant and equipment will total 8% more in 1962 than last year, based on latest survey of Commerce Dept. and Securities and Exchange Commission. Spending will hit a record $37.2 billion, according to the report, compared with $34.4 billion in 1961. President Kennedy's Council of Economic Advisers earlier tagged capital outlays at $40 billion for 1962, as part of its $570 billion GNP target for the year.

Electricity production in February was averaging about 11% more kwhr than for similar period of 1961. Output was averaging in excess of 16 billion kwhr weekly, with gains in all geographical areas.

National economy statistics covering the first quarter are disappointing to Administration aides and officials. Administration forecast is for a 1962 gross national product of $570 billion, up from $521 billion in 1961. GNP for the first quarter is expected to top $550 billion, and over $560 billion in the second quarter. But to average out at $570 billion for the year would require a boom spurt in the third and fourth quarters which now seems unlikely.

Current strengths in the economy include: GNP in first quarter was at a record annual rate of nearly $550 billion; new construction spending was at record annual rate of nearly $60 billion; industrial production was at record rate of 115% of 1957 average; personal income was at a record seasonally-adjusted annual rate of $432.8 billion; retail sales were at a record $18.9 billion seasonally-adjusted rate; employment in February reached 65.8 million, and unemployment fell to 4,543,000, or 5.6% of the workforce, lowest since July 1960.



Put the Honeywell preference to work for you with the stylish

New Honeywell Line-Voltage Electric Heat Thermostat

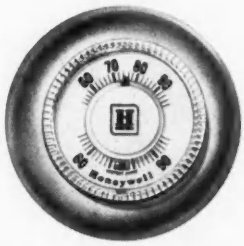
When Honeywell is on the wall, you're offering what Homeowners want (3 out of 4 prefer Honeywell controls according to a recent survey in cities across the country).

The wall-mounted T462 (above) and its integral unit-mounted counterpart—the T460—are the ideal line-voltage home thermostats. New construction makes them stronger. Now easier to set, too. Rugged and dependable—yet precise (½° differential) switching for operating electric heaters up to 5000 watts, responding to both radiant and convected room heat.

Get the facts about Honeywell. Just call the nearest Honeywell office or write: Honeywell, Dept. EC4-25, Minneapolis 8, Minnesota.

Two switching variations available: T462A and T460C are SPST, make on temperature fall, break line in NO HEAT position. T462B and T460D have the added feature of breaking both lines in the OFF position.

Honeywell Low-Voltage Round



Consider Honeywell low-voltage controls, too. With versatile R8097 Relay, you can offer the widest range of low-voltage thermostat combinations in the electric heating industry. You have complete choice from the most economical to the famous Honeywell Round to the deluxe thermostats and Control Centers.

Honeywell

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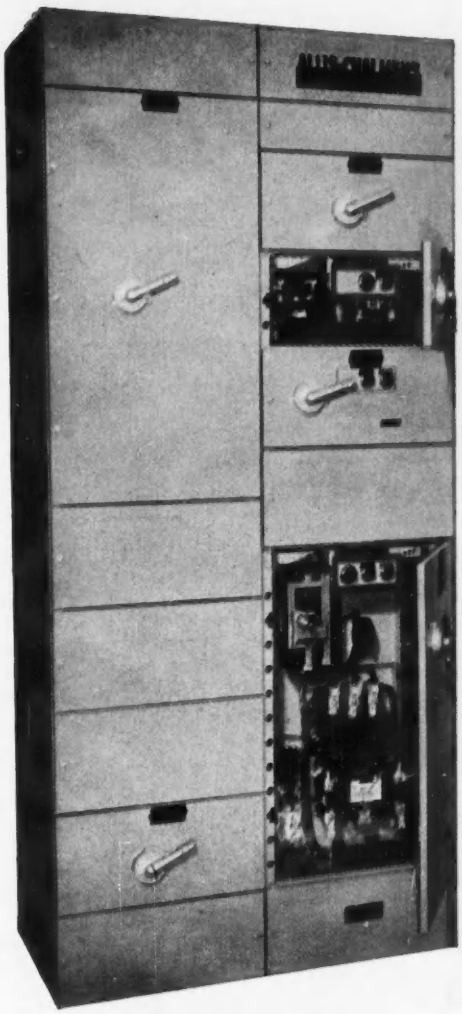
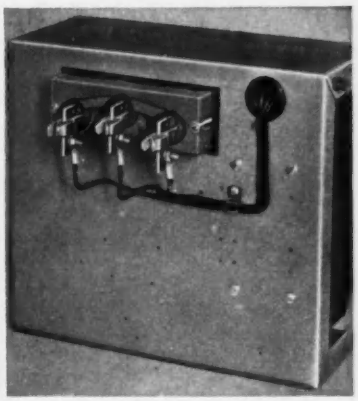
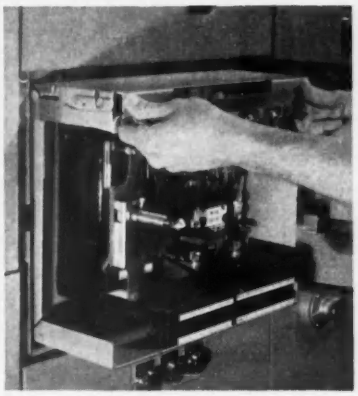


1. Centralized control saves space, cuts installation and engineering costs.

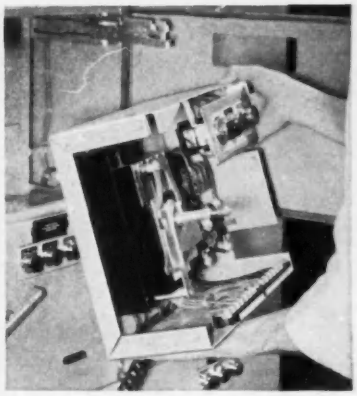
2. Exclusive plug-in terminal blocks permit removal of units without tools. Fully accessible location at front of units simplifies your wiring.



3. Extra heavy plug-in stabs and positive alignment provided by TRACK-GUIDE drawout mechanism assure trouble-free electrical connection.



4. With TRACK-GUIDE mechanism, units can be easily and safely de-energized and locked out, or withdrawn from enclosure for inspection and maintenance.



5. Units can be tilted up for inspection of stabs without removing from TRACK-GUIDE mechanism, or fully removed for bench maintenance or interchange.

...six reasons why Allis-Chalmers new motor control center design is

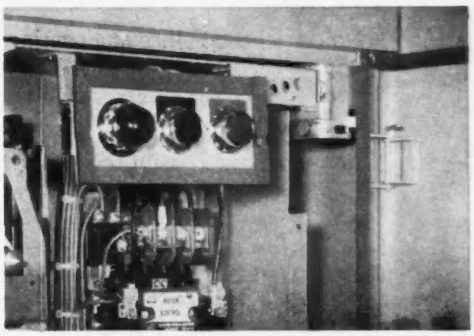
the center of satisfaction

Satisfaction? It comes with every one of the new (yet fully proven) low-voltage control centers from A-C. Their clean lean design saves valuable space. Exclusive plug-in terminal blocks cut installation time . . . speed inspection and removal. *Track-Guide* drawout mechanism lowers maintenance costs. Control units can be drawn out, tilted up, or completely removed without tools.

Safety features of these new control centers provide *sure* protection to personnel. Units can be quickly de-energized for maintenance or inspection work. Units cannot accidentally fall out of *Track-Guide* mechanism during inspection or maintenance.

Reliability . . . versatility . . . economy . . . strength . . . safety. You name the feature — A-C motor control centers have it. *Ask your A-C representative or distributor for all the facts. Or write* **Allis-Chalmers,** *Industrial Equipment Division, Milwaukee 1, Wis.*

Track-Guide is an Allis-Chalmers trademark. A-1486



6. Mounting of pilot lights and pushbuttons on the removable control units eliminates failures common with hinged wiring.

NEW VENTRAY... A-OK

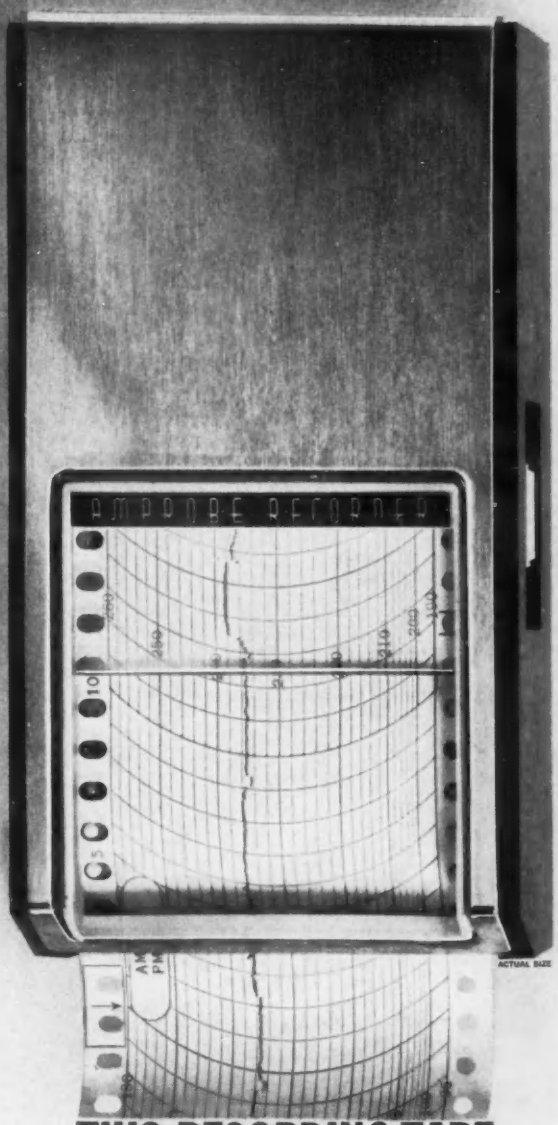
Low Material Cost—thru engineering know-how and modern advanced manufacturing techniques. **Low Installation Cost**—made possible thru lightweight steel design and rapid QIKLOK™ splice. **Interchangeable**—used with VENTRIB™ cable basket for maximum system flexibility.

Lake Erie Electric, contractor on the NASA job, is completely satisfied with the new low-cost, ladder type VENTRAY™. The VENTRAY and VENTRIB in-stock parts made difficult changes of direction and elevation (shown above) and the entire installation a simple assembly operation.

Mr. Wm. M. Leblang, Vice President of Lake Erie Electric, Inc., Cleveland, Ohio—says: "We were pleased with ease of installation due to your lightweight steel design. Your competitive price, accurate take-off, installation drawings and prompt order service all contributed to an efficient labor saving installation."

See your local representative or electrical distributor or write Husky Products, Inc.

HUSKY DIVISION OF **BURNDY** 5300 VINE ST., CINCINNATI 17, OHIO

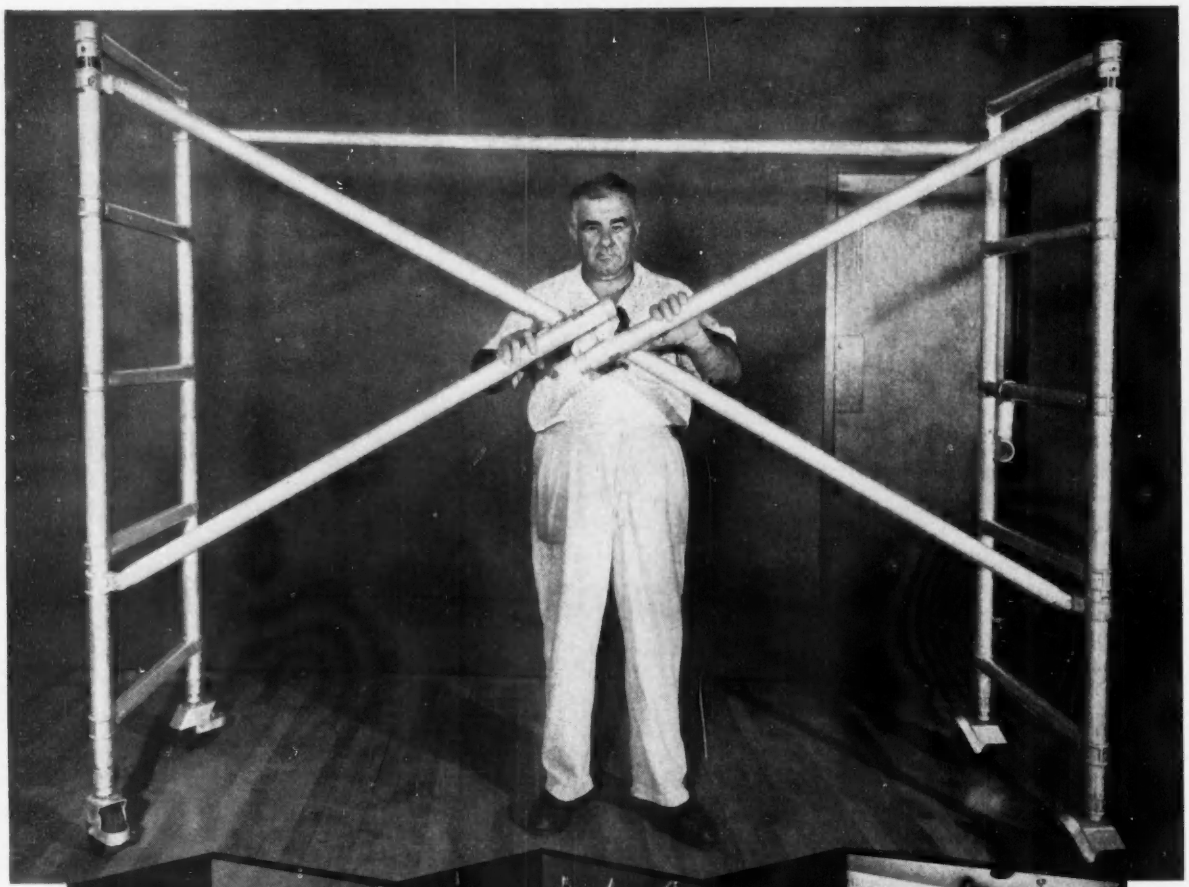


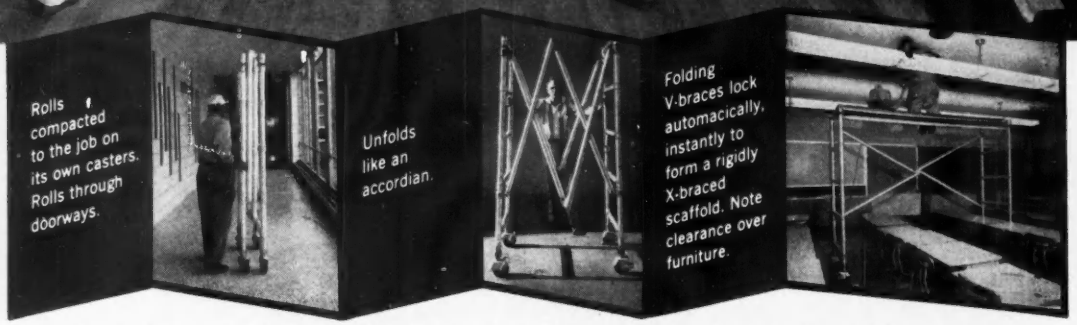
THIS RECORDING TAPE TROUBLESHOOTS FOR YOU 24 HOURS A DAY

The trouble with troubleshooting is that the electrical conditions which caused the difficulty often no longer exist when you get there. This usually develops into numerous, costly call-backs. But now, with the new, miniature Amprobe Recorder, you can obtain a continuous, permanent record of variations in voltage or current, as they happen, without the need for you to be present. The record is made automatically on a pressure-sensitive paper tape (no ink to spill or smudge) that loads easier than film into a camera. Without this chart in place, you can take direct meter readings. • The Recorder is rugged, completely portable and highly accurate. The expanded-scale voltmeter version, for example, records in two frequently used ranges (95-130 v AC and 190-260 v AC) to a tolerance of ±1 v. It sells for $84.85. Two clamp-on ammeters also are available: at $89.95 (ranges: 0/5/25/100/250 amps AC) and $94.85 (ranges: 0/10/50/250/500 amps AC). For complete details and specifications, see your Amprobe distributor or write today for a free catalog.

AMPROBE INSTRUMENT CORPORATION
630 MERRICK ROAD, LYNBROOK, NEW YORK
IN CANADA: ATLAS RADIO CORP., 50 WINGOLD AVE., TORONTO

New one-piece scaffold unfolds and locks into shape in 10 seconds!




Rolls compacted to the job on its own casters. Rolls through doorways.
Unfolds like an accordian.
Folding V-braces lock automacically, instantly to form a rigidly X-braced scaffold. Note clearance over furniture.

No tools required. No nuts, bolts, loose parts—nothing can be left out or lost! Platform height adjustable from 1 ft. to 8½ ft. Instantly adjustable legs. Lightweight aluminum: can be carried up stairs by 1 man. Compact: stores in same space as a step ladder. Interchangeable with all Up-Right span scaffolds in use.

UP-RIGHT

ALUMINUM VX SCAFFOLD

Write for circular: **UP-RIGHT SCAFFOLDS, Dept. 104, 1013 Pardee, Berkeley, Calif.**

FACTORIES: BERKELEY, CALIFORNIA AND TETERBORO, NEW JERSEY • In Canada: Up-Right Scaffolds Ltd., 120 Russett Ave., Oshawa, Ontario

HUGE NEW S. C. O. A. SHOPPING CENTER at West Covina, California, is lighted by 37 Twin and 7 Single L-M Stylaire mercury luminaires. These have 1000-watt pink-white lamps rated at 42,000 lumens per lamp, with an average light level of 4 footcandles on the blacktop surface. Units are mounted at 32-foot mounting height, on 25-foot fully galvanized steel poles, spaced 105-110-feet laterally and 115-feet transversely. Installation was made by Walters Electric, Los Angeles electrical contractors. Bruce Thyberg, the engineering consultant, is now president of Bruce Thyberg & Associates, in San Diego. Ballasts are built into the base. Installation is exceptionally easy. Units are available in brushed aluminum and five pastel colors, in two sizes for 400, 700, and 1000 watt mercury lamps, with or without photo controls.

L-M Twin Stylaire™ Mercury Luminaires Light New California Shopping Center

Striking new design, and color harmonizing with contemporary architecture major factors in selection of Stylaire luminaires for huge S. C. O. A. center in West Covina.

Smart, modern styling and high efficiency with a minimum of glare led Engineering Consultant Bruce Thyberg to select L-M's newest lighting luminaire, the handsome Stylaire, to light this new shopping center in West Covina, California.

West Covina, "City of Beautiful Homes," is the commercial center for the San Gabriel valley. The new S.C.O.A. (Serving Communities of America) center provides a wide variety of stores and services for this heavily populated area, and evening business is an important factor.

Mr. Thyberg decided on L-M Stylaire Mercury units because of their well-styled design, excellent glare-free lighting, and because relatively few units could be used to light the broad expanses of the parking areas, resulting in savings in poles, wiring, and installation costs. Thus these units provide high-level lighting and more parking area without a "forest" of poles taking up valuable parking space.

These units have wide acceptance for street and highway lighting, and for parking areas, public parks, malls, and hotel and motel grounds. They are particularly favored for airports because excellent light control eliminates upward glare.

ASK THE L-M FIELD ENGINEER

L-M provides a wide variety of lighting equipment and cooperates with engineering consultants in Lighting Applications. Call the Authorized L-M Distributor or nearest L-M office, for complete information on L-M equipment and services; ask the L-M Field Engineer or Lighting Engineer; or mail the coupon. In Canada: CLM Industries, McGraw-Edison(Canada)Limited, Toronto 13, Canada.

LINE MATERIAL®
Industries
560
McGRAW-EDISON COMPANY
Outdoor Lighting

McGRAW EDISON

DISTRIBUTION TRANSFORMERS • RECLOSERS, SECTIONALIZERS AND OIL SWITCHES
FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING
LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

Line Material Industries, Milwaukee 1, Wisconsin

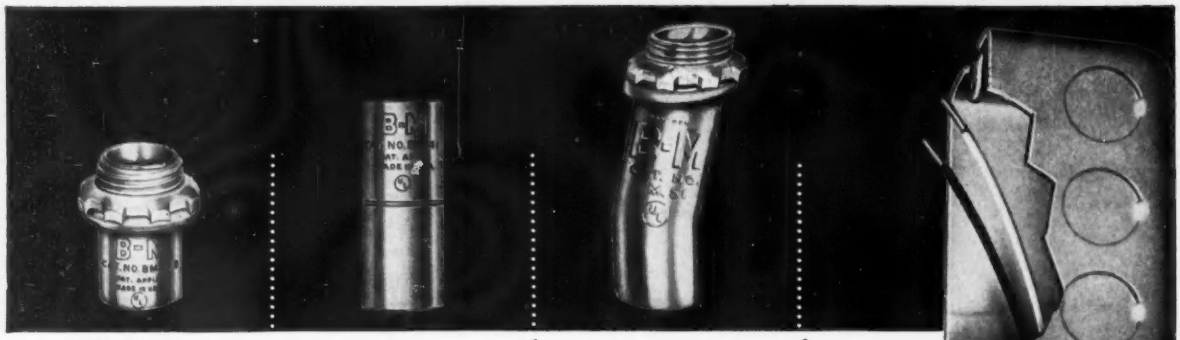
Please send information about your Styled Mercury luminaire line and name of nearest Authorized L-M Distributor. (ECM-42)

Name_____

Company_____

Address_____

City_____ State:_____



Red Throat
BM-21B
½" Connector
BM-22B
¾" Connector
BM-23B
1" Connector

BM-41
½" Coupling
BM-42
¾" Coupling
BM-43
1" Coupling

BM-51
½" Offset Connector
BM-52
¾" Offset Connector

BM Offset Connectors showing how wires are guided over box edge.

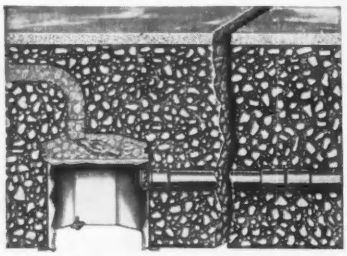
FOR MORE PROFITS

Save time and money with

B-M ORIGINAL INDENTER FITTINGS

Here is the combination that is unbeatable when it comes to easier E.M.T. installation at less cost. New lightweight plier size indenters make setting up thin wall conduit a breeze. B-M fittings are neater too! No unsightly nuts or projecting set screws.

A few more of the plus features of B-M fittings are Concrete tight—Vibration resistant—Extra heavy bright zinc plate, salt spray and acid drip tested for corrosion resistance—Extra heavy positive bonding locknuts—smooth rounded edges or bushed throat type connectors that prevent insulation damage—All steel construction with extra heavy gauge wall thickness.



ALL BRIEGEL FITTINGS ARE U. L. APPROVED AS CONCRETE-TIGHT

When setting E.M.T. in concrete you can make each job easier and more profitable by using Briegel All Steel Indenter Fittings that have UL approval as Concrete-Tight. Contractors everywhere recognize their cost cutting qualities and the fact that they make each wiring job a better job. It is only natural that Briegel Fittings are the most widely used E.M.T. connectors and couplings.

BM PLIER SIZE INDENTERS
BM—No. 607 ½"
BM—No. 608 ¾"

All B-M indenter type fittings far exceed the requirements of U. L. file card E 10863 and Federal Specifications W-F-406.

BRIEGEL METHOD TOOL CO.
GALVA • ILLINOIS

USED THE MOST FROM COAST TO COAST

CONTROL
CUTLER HAMMER
WHAT A BEAUTIFUL WAY TO SHOW HOW GOOD YOUR WIRING JOB IS

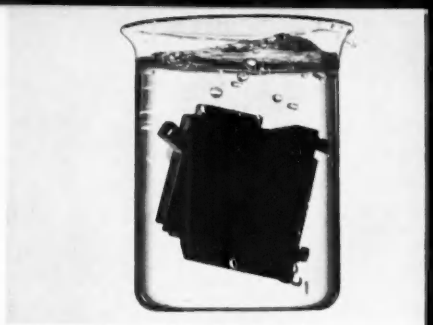
Looks so much better, installs so much easier . . .

Cutler-Hammer's NEW Safetybreaker*

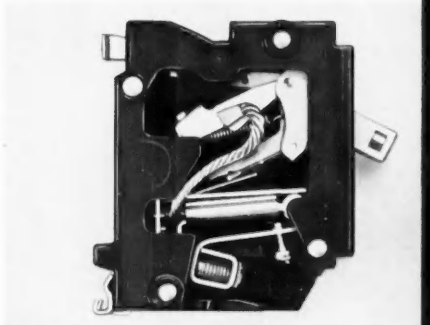
. . . far ahead in every way

Here's a bonus in beauty and protection that gives you—and your homeowner customer—many exclusive features at *no extra cost.*

Why install the old-fashioned "basement gray" box when this modern appliance styling is available for the same—often lower—price?



WON'T RUST, WON'T CORRODE. Every operating part is either stainless steel or heavily plated for rust and corrosion resistance.



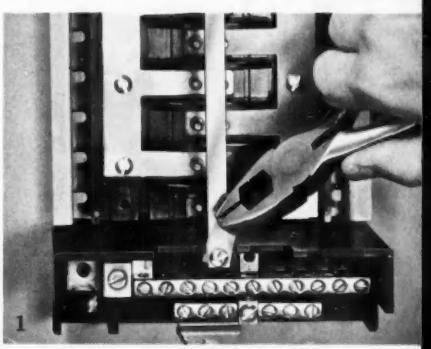
DOUBLE PROTECTION. Both magnetic trip for short circuits and a bimetal trip for sustained overloads.

Simplest, most foolproof non-interchangeability system by far

Safetybreaker's simplified non-interchangeability is as far ahead of competition as its styling. There's no fussy keying system. No special tools or "can openers" are required. It's impossible to break off or incorrectly position tabs. See your Cutler-Hammer distributor for a 60-second demonstration. Try it. Prove to yourself how much better, how much easier to install the Safetybreaker is.

Here's how the simple "up-down" N. I. system works:

1. Tear off plastic spacers to loosen locking bar screws, and let locking bar drop.
2. Plug in breakers in top portion of panel. Slide bar to top of panel.
3. Plug in remaining breakers. Tighten two special screws to lock the N. I. system. That's all there is to it!



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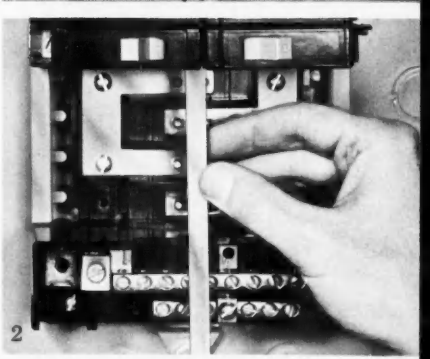

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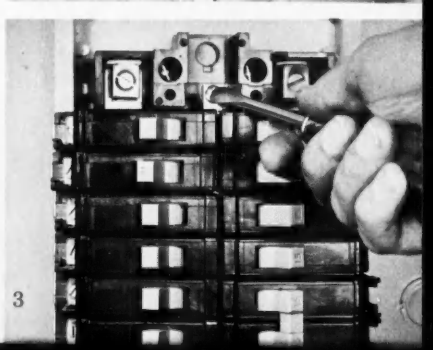


3

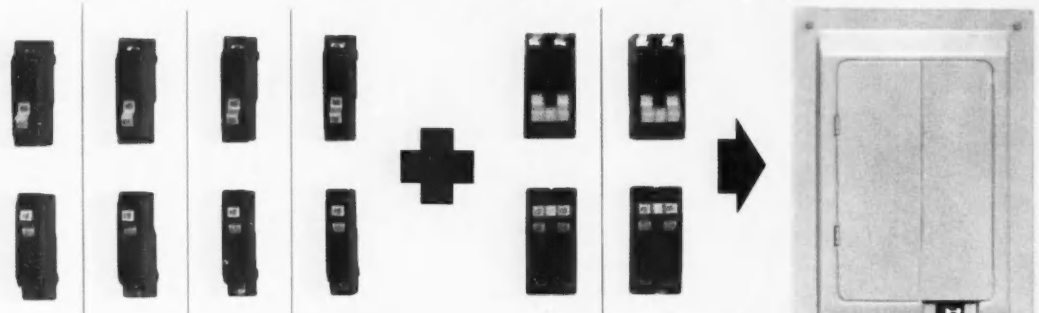
CONTROL

CUTLER-HAMMER

*Cutler-Hammer Trademark

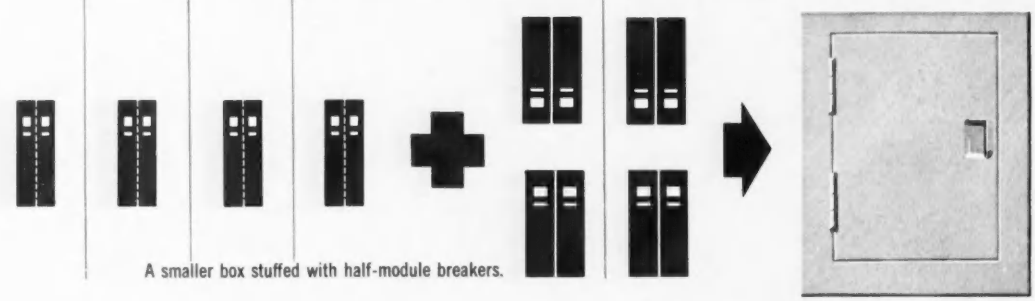
H
CONTROL
CUTLER HAMMER

CUTLER-HAMMER'S FULL SIZE SAFETYBREAKER IS COMPETITIVE WITH "MIDGET" BREAKERS



A full-size installation of generously designed Cutler-Hammer Safetybreakers.

$70.30 LIST



A smaller box stuffed with half-module breakers.

$70.30 LIST

GREATER VALUE FOR THE MONEY

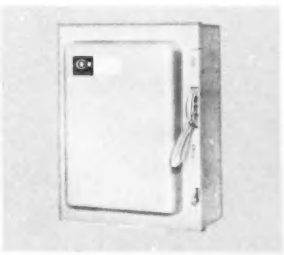
Contractors who use SAFETYBREAKERS know that:

they can provide their customers with FULL SIZE SAFETY-BREAKER protection and value for no more . . . often less, than other contractors pay for half-size installations.

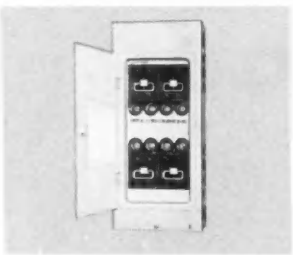
Cost aside, it's a fact that more and more electrical inspectors are insisting upon the use of only FULL SIZE circuit breakers. Their reason . . . FULL SIZE SAFETY-BREAKERS don't offer an opportunity to violate local and national safety codes. Several cities have already outlawed half-size breakers and the number is growing.

Take another look at the actual example illustrated above. Then take a look at the handsome styling, the superior ease of installation, the advanced protection you get with Cutler-Hammer Safety-breakers. The man to see is your Cutler-Hammer distributor.

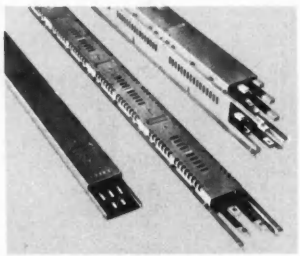
For top performance... these other Cutler-Hammer products



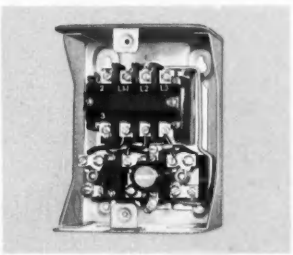
Safety Switches



Fusible Entrance Equipment



A complete line of bus-duct



General purpose motor control

WHAT'S NEW AND BETTER? ASK...

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Divisions: AIL; Mullenbach • Subsidiaries: Uni-Bus., Inc.; Cutler-Hammer International, C.A. • Associates: Cutler-Hammer Canada, Ltd.; Cutler-Hammer, Mexicana, S.A.

CONTROL

Washington National Airport, Washington, D.C., 1939.

...and hasn't been heard from since

That's only 23 years. Some of our installations go back as much as *60 years* and "haven't been heard from since." With more miles in use than any other conduit, Orangeburg Brand Fibre Conduit has proved itself job by job, time after time. No wonder it's the sought-after-brand for every application.

We introduced fibre conduit in 1893, and it was a superior product then. Over the years we've steadily improved it...with such innovations as fast-assembling C.A. (coupling attached) Conduit and klean-kote (for cleaner handling). As a result, Orangeburg Brand Fibre Conduit has maintained its superiority, retained its place as the unquestioned leader in its field. So ask for—and make sure you get—*genuine* Orangeburg Brand Fibre Conduit.

KLEAN-KOTE*

ORANGEBURG®

BRAND

FIBRE CONDUIT

FLINTKOTE®

*KLEAN-KOTE IS A TRADE-MARK, U. S. PATENT APPLIED FOR.

Orangeburg Klean-Kote is distributed by Graybar Electric Company and General Electric Supply Company with Branches and Stocks in Principal Cities.

Orangeburg Manufacturing Co., Orangeburg, New York. Division of The Flintkote Company, Manufacturer of America's Broadest Line of Building Products

DuKane

DEPTH OF EXPERIENCE

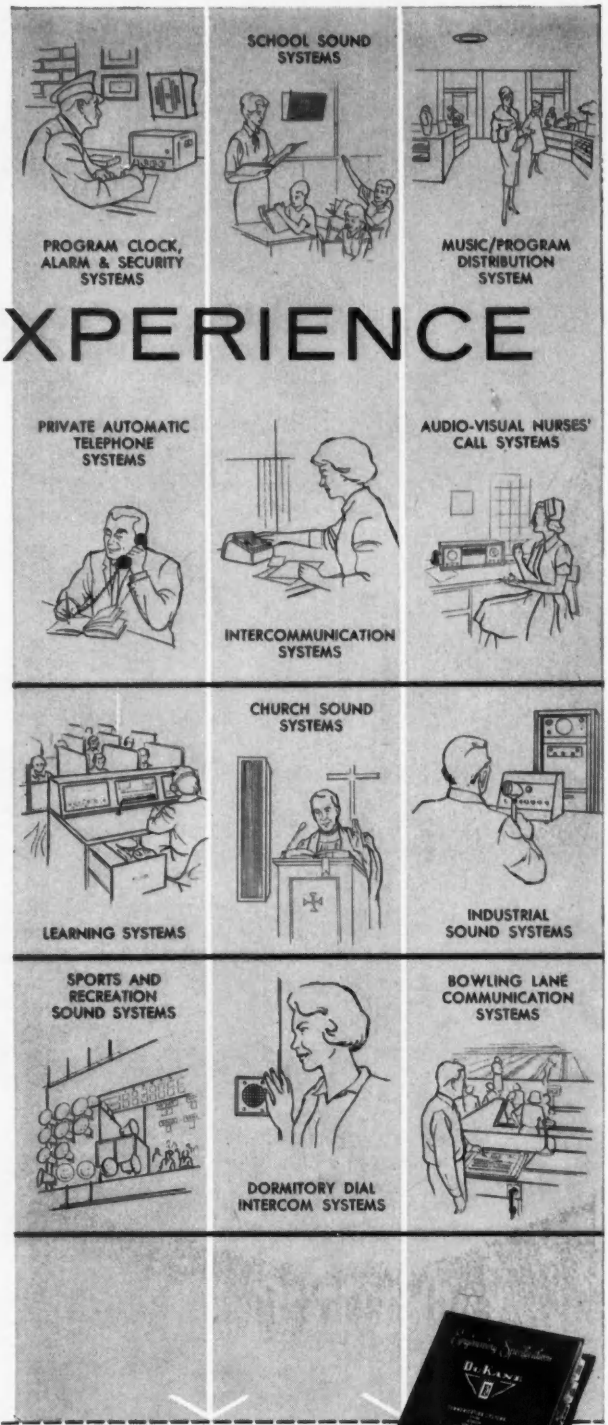
IN SOUND AND COMMUNICATION SYSTEMS

Experience counts—
count on DuKane!

Thousands of DUKANE commercial sound and communication system applications are turning in enviable daily records of efficiency, dependability, low maintenance and long life. All of this experience is as near as your telephone.

A call to your local DUKANE distributor provides you with a sound and communication system expert completely familiar with paging, program distribution, internal communications, clock signals, private telephones and many more. Your DUKANE distributor is fully trained to assist you in planning and selecting an appropriate system to meet all sound and communication needs, supervising its installation for maximum life, serviceability and good looks and following up the system installation with service to maintain complete customer satisfaction in the years to come.

Schools, hospitals, churches, industrial, business, institutions, hotels, motels, recreation and sports areas, etc., rely on the local DUKANE distributor for Depth of Line, Depth of Experience and Depth of Services. Contact him—get his know-how working for you now.



WRITE TODAY FOR FULL DETAILS & SPECIFICATIONS ON ALL DUKANE SOUND AND COMMUNICATION SYSTEMS

NAME_____

TITLE_____

FIRM_____

STREET_____

CITY_____ STATE_____

DuKANE CORPORATION

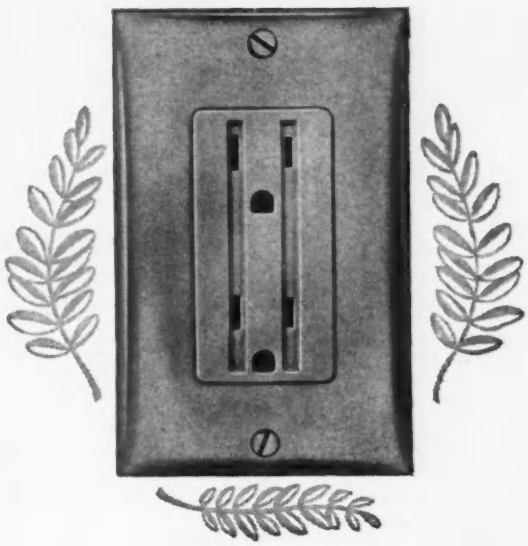
COMMERCIAL SOUND DIVISION

DEPT. ECM-42 / ST. CHARLES, ILLINOIS

MEDALLION
WIRING DEVICES
by Slater ELECTRIC INC.

For service above and beyond the ordinary . . . Medallion wiring devices provide a new design accent for contemporary interiors. To match these modern specification grade grounding outlets, four switch models are available including quiet switches and rocker switches. Medallion wiring devices may be ordered in any of five colors. Write today, for full information

Slater ELECTRIC INC.
GLEN COVE, NEW YORK

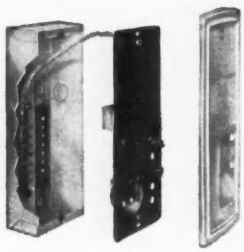


NEW... most beautiful Apartment Telephones ever made!

- Equipped with cordless loudspeaker or watchcase receiver—your choice
- Modern, slim, streamlined design
- Aluminum face plate with beautiful anodized finish in brushed gold or silver
- Plug-and-receptacle installation
- Easiest telephone in the world to install and maintain
- Excellent voice reproduction
- Competitive price
- Pleasant-sounding audible signal
- Flush, semi-flush or surface wall mounting

Auth vestibule and lobby telephones also have been re-designed and are the last word in appearance and efficiency. Get complete facts today.

Apartment and vestibule telephones illustrated are cordless loudspeaking type. Also available are apartment telephones with watchcase receiver as indicated.



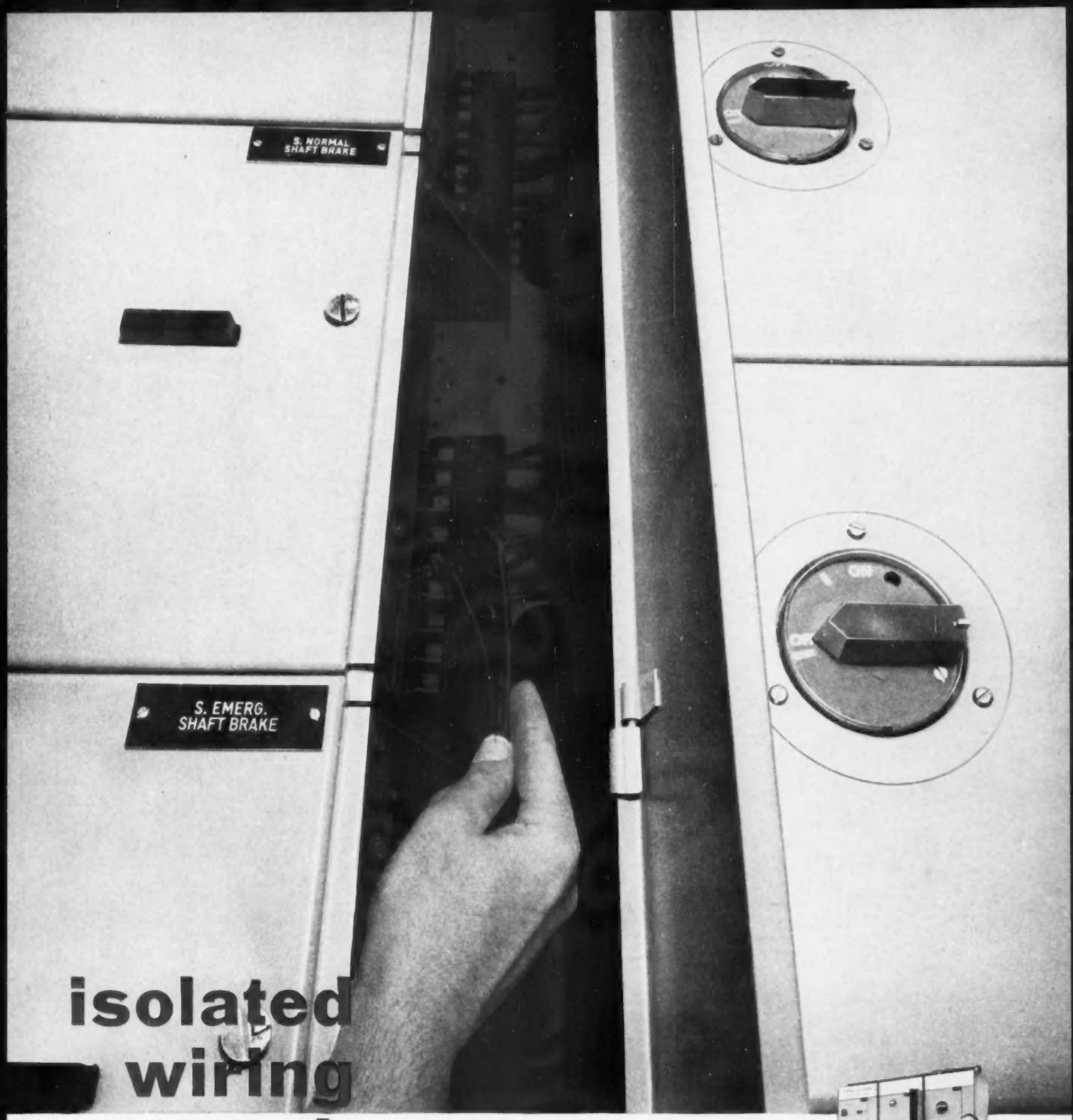
Exploded view of cordless loudspeaking telephone

Watchcase receiver type

Auth
SINCE 1892

ELECTRICAL SIGNALING, TIME AND COMMUNICATION SYSTEMS FOR HOSPITALS, SCHOOLS, HOUSING, INDUSTRY AND SHIPS

Auth Electric Company, Inc.
LONG ISLAND CITY 1, NEW YORK



isolated wiring trough

lets you lay-in wires, make load and control connections without disturbing starter units. Helps cut installation time in half. It is just one of more than 40 features of the ***7700-LINE CONTROL CENTER*** which give you the best protection, fastest installation, simplest maintenance in grouped control. See your G-E Sales Representative or write for Bulletin GEA-7238 to Sect. 783-23, Schenectady, N.Y. *General Electric Co., Salem, Va. and Plainville, Conn.*

GENERAL ELECTRIC

what's in the cards for you?

Skilled Operators . . . trained to use modern and efficient powder actuated tools for fastening wood to steel or concrete; steel to steel or concrete; quickly, easily, at low cost. The Skill, Ability, Efficiency of a Qualified Operator: these, and the use of modern tools and equipment, maintain safety records, meet production schedules, create new ways of doing jobs better. Qualify all your field operators **now!**

The Powder Actuated Tool Manufacturers' Institute recommends adoption by state agencies of uniform codes for the design and use of powder actuated tools; coordinates training programs for powder actuated tool operators; coordinates field demonstrations; provides complete information on this modern fastening system.

Simply mail this coupon today!

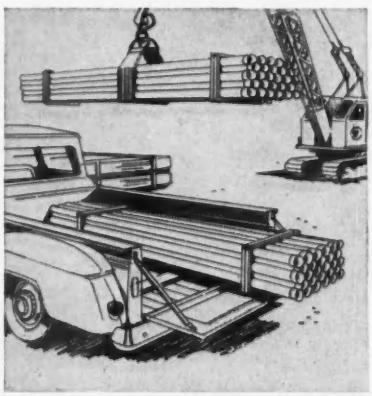
To: Powder Actuated Tool Manufacturers' Institute, Inc. ECM4
200 College Street, New Haven 10, Connecticut
Please send me information on powder actuated tool fastening.

NAME _____ TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

No representative will call, unless you so request.

Member companies: **NELSON / OMARK / RAMSET / REMINGTON / STAR**

NOW easy handling aluminum conduit SQUARE-PACK from Alcoa



FAST, EASY UNLOADING with Alcoa's square-pack bundles. They can be picked up in the center, using a sling suspended either from a crane or a boom extension attached to the fork of a lift truck. The lightweight bundles range from 522 to 798 pounds, depending on conduit size, and can easily be handled with a half-ton lift truck.

Here's one way to stack aluminum conduit at the job site and still cut handling costs.

Alcoa® aluminum rigid conduit is now available in convenient *square-pack* bundles, for fast, easy unloading. Held together by steel tape over grooved wood battens, the conduit can be moved from the truck to stacking point in one simple operation.

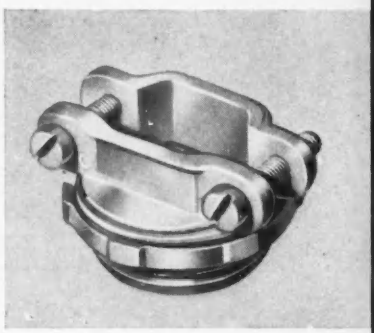
Economical and safe. Your biggest saving comes from quick unloading —by minimizing handling of individual pipes. In addition, you can expect less damage or loss during handling. When ready for use, Alcoa *square-pack* bundles can be broken simply, by cutting the steel bands that hold the battens in place.

Ask your nearby Alcoa-Rome distributor to supply aluminum rigid conduit in this new, convenient *square-pack*. For detailed information on weights, dimensions and footage, write to Rome Cable Division of Alcoa, Dept. 7-42, Rome, N. Y.

Conforms to ASA C80.5-1960-Rigid Aluminum Conduit and Federal Specification WW-C-540a.

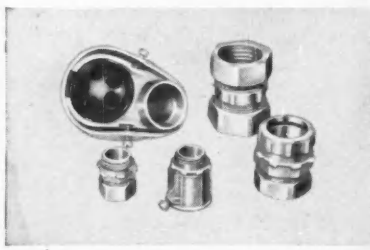
ALCOA
ROME CABLE
DIVISION

NEW FROM RACO



Oval Service Entrance Cable Connectors. These new pressure-cast oval service cable connectors feature a newly designed shorter throat. The sturdy, non-watertight connector attaches easily to service entrance switch. Clean, smooth threads and burr-free edges eliminate danger of wire snagging and damaged cable. Available in five sizes from ¾" to 2".

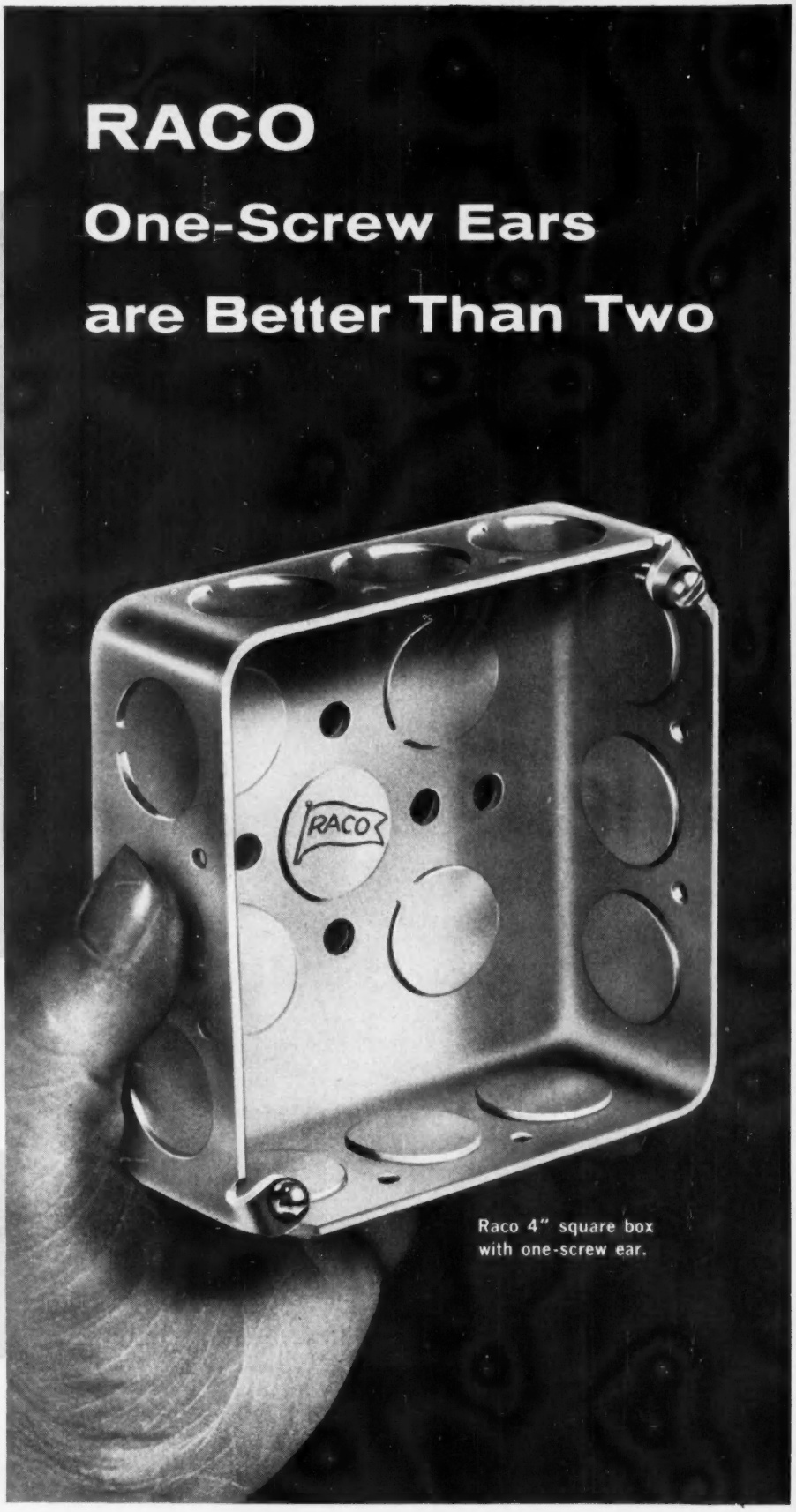
Offset Mast Base Reducer. New Raco offset mast base reducer threads directly into meter box. No nipple needed. One piece for easier, faster handling. Offset design makes it perfect for use next to a wall. Available in four popular sizes—2"-1¼", 2"-1½", 2½"-1¼" and 2½"-1½".



Fittings For Every Need

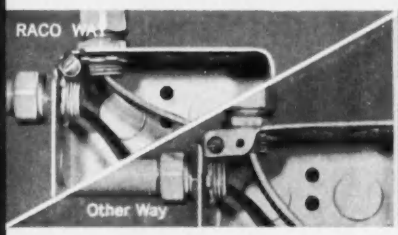
- Rigid Conduit
- E.M.T. (thinwall conduit)
- Armored bushed cable, flexible metallic tubing and non-metallic cable
- Service entrances

RACO
One-Screw Ears are Better Than Two

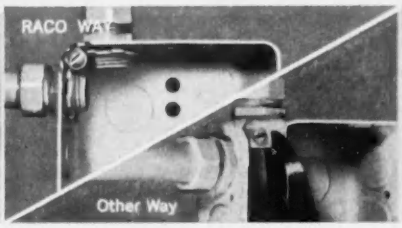


Raco 4" square box with one-screw ear.

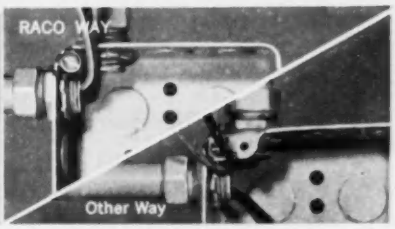
One-screw ear gives you flexibility



MORE WORKING ROOM
Raco one-screw ear design boxes give you more working room. Result: More wiring room, all KO's usable, two extra runs per box.

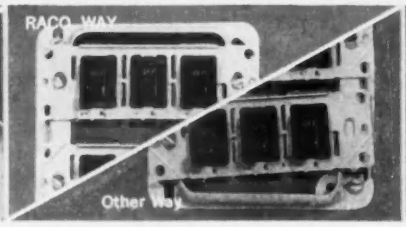


NO EARS TO CLIP
No lost motion clipping ears. No screws to move or lose using Raco one-screw ear boxes.

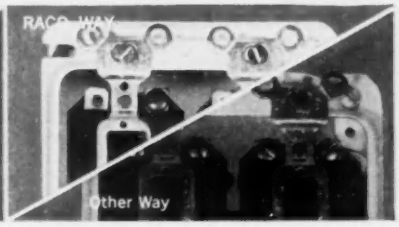


NO WIRE SKINNING PROBLEMS
With Raco's **one-screw ear** design, wire comes through clean—no skinning. You have more room. Smaller ears don't get in the way.

MOUNTS IN ANY POSITION
Whatever position you mount these versatile boxes in, you're always right. You can't install them wrong.

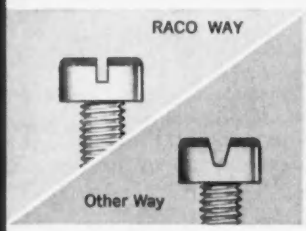


SPECIAL APPLICATIONS
Due to the design of Raco's **one-screw ear** box, you have plenty of room for despard devices or as a transformer housing.

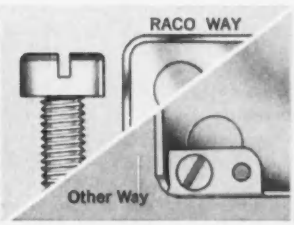


HEAVY DEVICES MAY BE USED
The one-screw ear gives you more working room when installing switches and heavy duty receptacles. Get speedier installation.

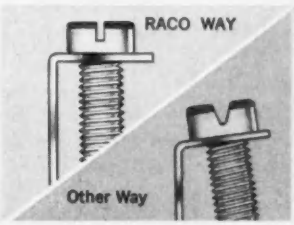
Raco quality saves you money



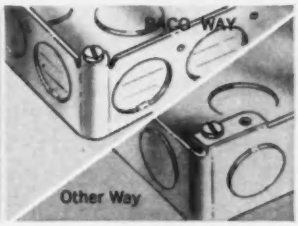
SQUARE SCREW SLOTS. A screw driver won't slip out of the milled slots in Raco screws. No wasted motion—no loss of time.



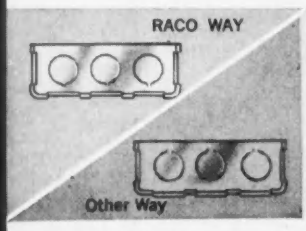
SCREWS PLATED SEPARATELY. Every screw—and every clamp—is plated before it is put in a Raco box. No rusting. Little details pay off in big savings.



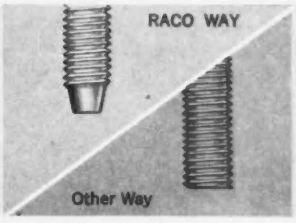
SQUARE EARS. Ears on Raco boxes are always 90° angle. You waste no time "pulling down" ears. Raco boxes are always square, never distorted.



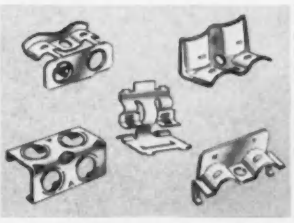
KO TIES AT BOTTOM. You can reach in a Raco box and remove any knockout with ease. Just twist, pull and you're ready to roll. Try it.



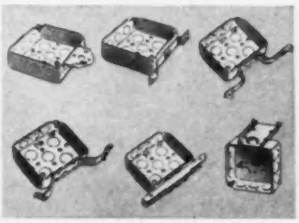
BOTTOM KO's. Clean-cut, Raco bottom KO's are on the inside of the box. It's easier to reach in, than around.



DIE-POINTED SCREWS. Raco's specially designed die-pointed screws go in speedier and easier. The time saved adds up to big dividends for you.



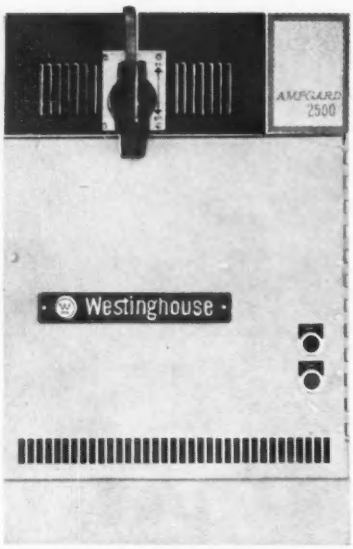
CLAMPS FOR EVERY JOB. There's a Raco one-screw ear box with a metallic or non-metallic cable clamp you need. • Q clamp • X clamp • L clamp • C clamp • N clamp



WIDE RANGE OF MOUNTING BRACKETS. Raco 4" square boxes are available with these brackets. • B bracket • O bracket • F bracket • A bracket • W bracket • J bracket

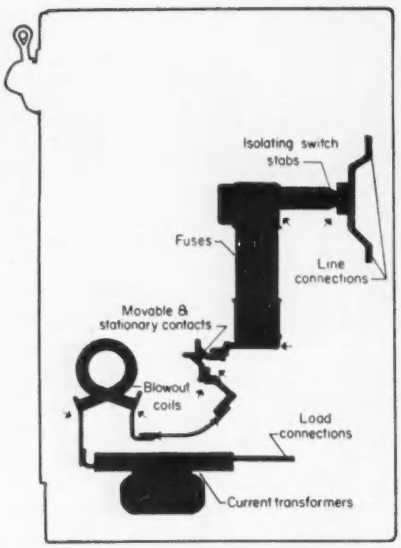
RACO®

ALL-STEEL EQUIPMENT INC., Aurora, Illinois



Ampgard® 2500

A new design concept in starters to match all of your 2300-volt motors.

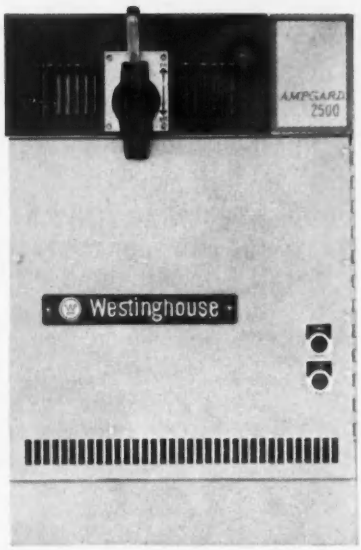


Most Advanced Design

Component-to-component connections reduce current-carrying junctions 50%, eliminate internal bus and cable, and reduce heating.

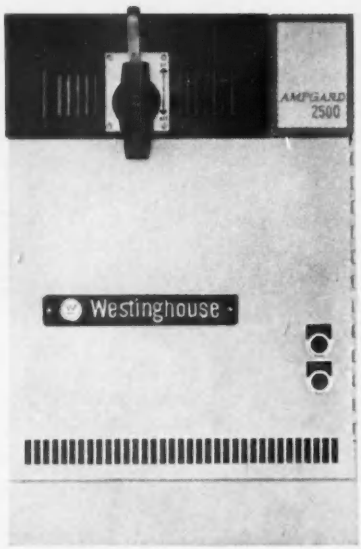
Lowest Initial Cost

Saves as much as 20% over old-type conventional higher voltage starters. Lowest cost 2500-volt motor-starter on the market to own and operate.



Safest to Operate

Complete system of six interlocks, nine other safety features protect your personnel and equipment.



Quickest to Install and Maintain

Comes completely assembled. Easy two-man installation. All major components are modular-drawouts, front-accessible for quick inspection. Overhaul requires only 45 minutes.

Most Compact

One, two or three units can be stacked in a single 90″ high enclosure for compact floor mounting. Arranged this way, they occupy only 5.4 square feet of floor space ... much less than other starters. With low voltage starters added, they form a centralized motor control center.

See the Ampgard 2500. Your Westinghouse sales engineer has all the facts and will gladly give you a complete product feature demonstration. Or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. *You can be sure . . . if it's Westinghouse.*

J-25016

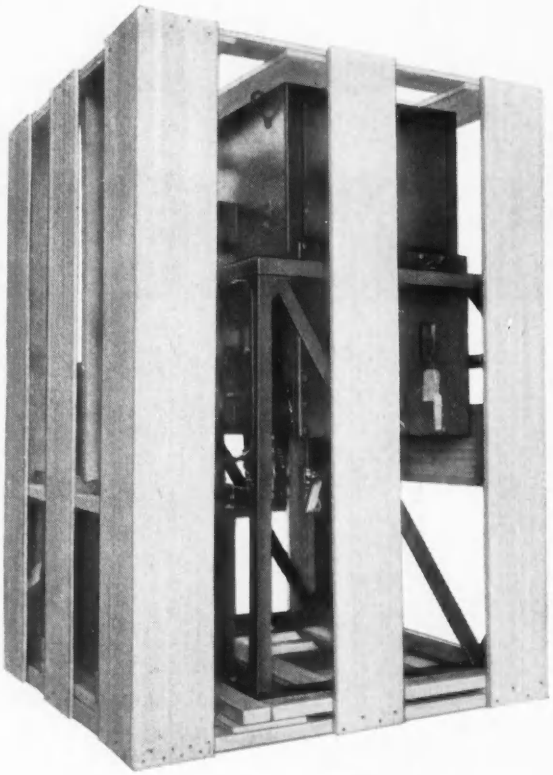
Westinghouse

G&W
Type RAD Switch
for industrial plant
in Illinois

G&W
Type DRA Switch
for ocean-front hotel
in Florida

G&W
Type RAL Switch
for shopping center
in New Jersey

G&W
Type RAL Switch
for utility lines
in California



G&W
Type RA Switch
for connecting lines
in Wisconsin

G&W
Type RAM Switch
for university
in Louisiana

G&W
Type FCRA Switch
for switching-fusing
in Canal Zone

G&W
Type RAD Switch
for newspaper plant
in Michigan

G&W
Type RAD-F6 Switch
for transfer switching
in Pennsylvania

G&W
Type RAD Switch
for airport lights
in Okinawa

This switch solved a problem just like yours!

From Caracas to Bangkok—New York to Arizona —G&W Type RA Switches solve difficult distribution fusing and switching problems, whatever and wherever they may be. Application may be on dams in Iran, for manual switch-fusing in the Canal Zone, for automatic operation in Okinawa, for transfer switching in a Pennsylvania hospital, or for pneumatic operation on a transmission line in Brazil. RA Switches are custom-built to meet particular or unusual switching needs with the reliability demanded at the most critical locations.

There is a G&W type for your job. RA Switches are suitable for either manual or automatic operation and are submersible. Insulation levels equal or exceed industry standards. G&W Load-Break Switches require minimum attention or maintenance, are shipped with all joints properly tested for tightness and internal fittings properly assembled for immediate operation.

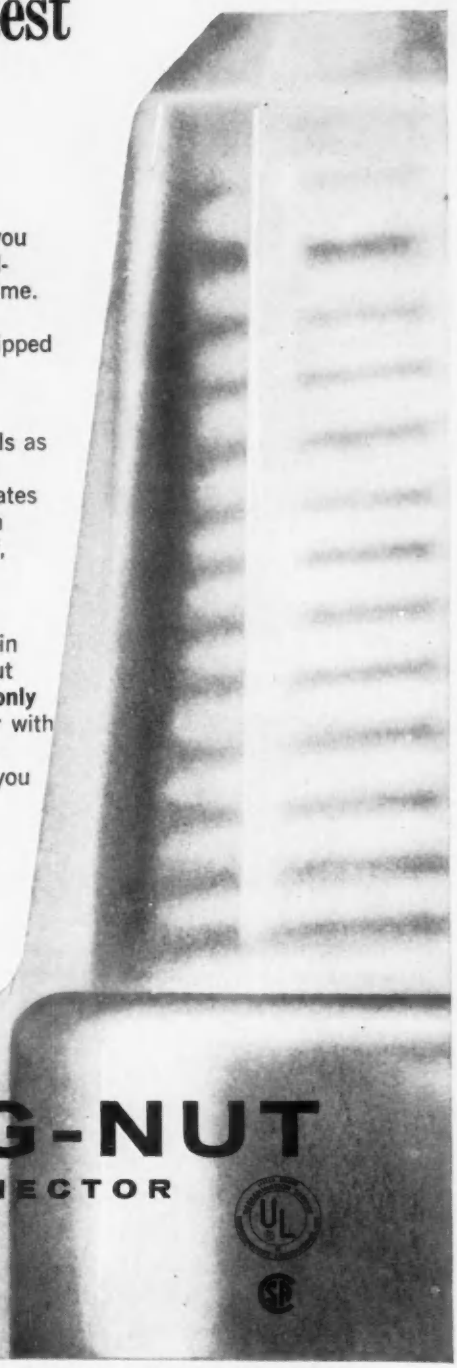
Ask your G&W representative for facts on now you can save equipment and installation costs with the proven flexibility of RA Load-Break Switches, or send for G&W Catalog DB-51. Your special needs are our business.

G & W ELECTRIC SPECIALTY COMPANY
3500 WEST 127th STREET • BLUE ISLAND, ILLINOIS
CANADIAN MFR. • POWERLITE DEVICES LTD. • TORONTO, MONTREAL & VANCOUVER

superior quality standards — inspired specialized design

D 62-1

for the easiest, fastest, tightest connections – you need . . .



the WING

—the only built-in wrench, gives you terrific leverage . . . lets you **hand-twist** a perfect connection every time. Quickly splices even the largest, stiffest wires. Wings are easily clipped off for tight spaces.

the SPRING

—a tension-spring coil that expands as wires are fed into it—threads and crushes wires together—compensates for expansion and contraction with "breathing" action—a shake-proof, fool-proof lifetime splice.

the NYLON SHELL

—won't cold-flow, won't stretch thin and pop under pressure to short-out connections. WING-NUT is the **only** screw-on branch circuit connector with unbreakable, high-dielectric Nylon shell—the strongest, safest shell you can buy!

3 SIZES
—fit every branch circuit and fixture hanging need!

WING-NUTS SHOWN ACTUAL SIZE

you get all three only with

IDEAL

WING-NUT

CONNECTOR

Sold through America's Leading Distributors • In Canada: Irving Smith. Ltd., Montreal

Please send me a pocket-full of ***FREE SAMPLES***

Fill in and mail coupon, and Ideal will send you a **pocket-full** of WING-NUTS—plenty to let you see why they're America's most popular wire connector.

IDEAL INDUSTRIES, Inc., 1041-D Park Avenue, Sycamore, Illinois

Name.....

Company.....

Address.....

City.....Zone.....State.....

. . . incandescent **WALL BRACKET**

made of die-cast aluminum

No. 3672
with Widespread Amcolens

No. 3670 with Asymmetric Arealens

No. 3673 with White Amtex glass

The lighting of areas adjacent to *outdoor* walls can now be achieved with this attractive *new* wall bracket—completely gasketed between lens, ring, housing and junction box. Varied light distribution performance is provided with optional choice of Widespread Amcolens, Asymmetric Arealens and White Amtex glass. Die-cast aluminum has Universal Metallic finish which is compatible with exterior wall materials. Write for Bulletin No. WE2-362.

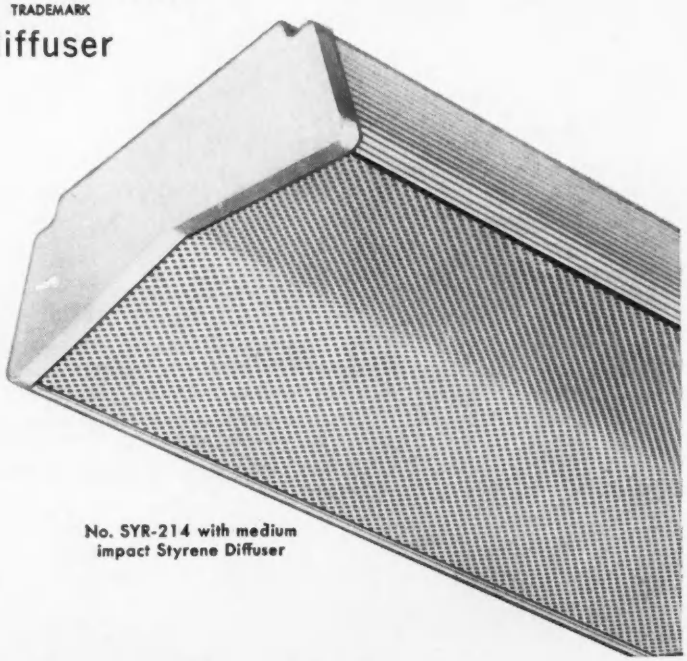
Art Metal Lighting Division
1814 EAST 40TH STREET, CLEVELAND, OHIO
Wakefield Lighting Limited
LONDON, ONTARIO

Two New Luminaires by WAKEFIELD CORPORATION

. . . fluorescent **SYMMETRIC**
TRADEMARK

fully enclosing styrene diffuser

The lighting of classrooms, offices, drafting rooms and stores can be provided with this *new* fully enclosed luminaire, equipped with Wakefield's popular sliding clamp hanger for easy and economical installation. The Symmetric is available in two lamp and four lamp widths in four foot and tandem eight foot lengths. The one piece, frost clear, styrene diffusers can be readily removed for washing. Write for specification sheet No. SYM-162.



No. SYR-214 with medium impact Styrene Diffuser

Wakefield Lighting Division
VERMILION, OHIO
Wakefield Lighting Limited
LONDON, ONTARIO

ADVANCE In-warranty Labor Insurance compensates for normal ballast replacement labor cost

what is ILI?

The ADVANCE TRANSFORMER CO. ILI (In-warranty Labor Insurance) Program is designed to reimburse the Electrical Contractor for normal labor costs incurred in replacing ADVANCE In-warranty High Power Factor Fluorescent Lamp Ballasts.

ILI permits the Contractor to guarantee both labor and ballasts in fluorescent lighting installations. It gives fast and more efficient service for lighting equipment manufacturers' products if an ADVANCE Ballast becomes inoperative within the two-year warranty period.

Here's how ILI works . . . . . .

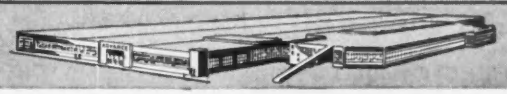
1 The Electrical Contractor contacts his ADVANCE Representative when he experiences an ADVANCE in-warranty ballast failure. The ADVANCE Representative will qualify the job and issue an (In-warranty Labor Insurance) ILI number.

2 The Electrical Contractor takes the inoperative ballast together with the (In-warranty Labor Insurance) ILI number to any ADVANCE Service-Stocking Distributor. The Distributor supplies the Contractor with new ADVANCE Ballasts at no charge and gives the Electrical Contractor an ILI form.

3 The Contractor completes and sends the form to ADVANCE TRANSFORMER CO., 2950 N. Western Avenue, Chicago 18, Ill. He receives a non-negotiable check for replacement labor cost which will be redeemable in merchandise at any ADVANCE Service-Stocking Distributor.

WRITE FOR COMPLETE ILI BROCHURE

"The Heart of the Lighting Industry."



ADVANCE®

WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF FLUORESCENT LAMP BALLASTS

TRANSFORMER CO.

2950 NO. WESTERN AVE. CHICAGO 18, ILL. U.S.A.

WAGNER® INSULCOAT MOTORS

OFFER TWO-WAY SAVINGS

OVER STANDARD TOTALLY-ENCLOSED MOTORS

1 IN INITIAL COSTS . . . Insulcoat motors can be used in many applications that formerly required more costly totally-enclosed motors—in atmospheres involving moisture, salt spray, oils, chemicals, acids, dust, carbon black and other contaminants.

2 IN HIGHER SERVICE FACTOR . . . Insulcoat motors have the same service factor as conventional open-type motors. This 1.15 service factor, as compared to the 1.0 service factor of totally-enclosed motors, often lets you specify a smaller horsepower rated Insulcoat motor for a given job.

The stator coils of Wagner® INSULCOAT MOTORS are completely sealed against severe environments by a tough, flexible coating of epoxy resin. The coating has high dielectric strength—the whole stator insulation system is one unbroken unit. The Wagner method of applying Insulcoat puts it on the stator coil in the proper thickness for maximum protection, yet allows ready transmission of heat from the coils. This heat dissipation factor, the double end ventilating system, and the free flow of air under and around the end coils, results in a cool-running, long lasting, dripproof motor. For a motor that will do the job of a totally-enclosed motor but costs less . . . that gives proven protection against most forms of corrosion and foreign elements and has longer life through cooler operation . . . investigate the WAGNER INSULCOAT MOTOR. Your nearby Wagner Sales Engineer has all the details.

Wagner Electric Corporation
6413 PLYMOUTH AVENUE, ST. LOUIS 33, MO., U.S.A.
Manufacturers of LOCKHEED® Products

WM62-5

WIREMOLD® ELECTRIC IDEAS

PREPARED EACH MONTH FOR ELECTRICAL CONSTRUCTION AND MAINTENANCE TO BRING IDEAS, NEWS AND HELPFUL INFORMATION TO ELECTRICAL MEN

63rd YEAR

APRIL 1962

AIR CONDITIONING WIRING ..... FIRST PAGE
CODE COMMENTS ..... FIRST PAGE
EDITORIAL ..... SECOND PAGE
PRODUCT OF THE MONTH ..... SECOND PAGE
QUIZ CORNER ..... SECOND PAGE
COUPON FOR FREE ITEMS ..... SECOND PAGE
ENGINEERED SPECIALS ..... FOURTH PAGE
NOTEWORTHY ..... FOURTH PAGE
PRACTICAL TIPS ..... FOURTH PAGE

Air Conditioning Wiring Simplified by Raceways

Surface metal raceways prove to be simple, economical way to wire for air conditioning

Surface metal raceway is a practical and economical method of wiring for air conditioning.

Many structures, erected before room air conditioners were commonplace, are equipped with electrical distribution systems that make no provision for the increased load resulting from the use of air conditioners. This problem faces many owners of apartments, hotels, office buildings and other institutions that must remain open during construction.

The recent installation of 128 room air conditioners in a nine-story hotel shows how the problem of providing new circuits to handle additional electrical loads was solved quickly and conveniently with Wiremold 3000 and 500.

Extending from a panel box on each floor, the 3000 carries conductors for the branch circuit feeder system down both sides of the hallway. The branch circuits to each room are carried in 500. A Wiremold 5748 receptacle box was installed in each room for the air conditioning unit.

A 5781 Box Connector was used to connect the 500 to the 3000. This same system was used on each floor of the hotel. The raceway was then

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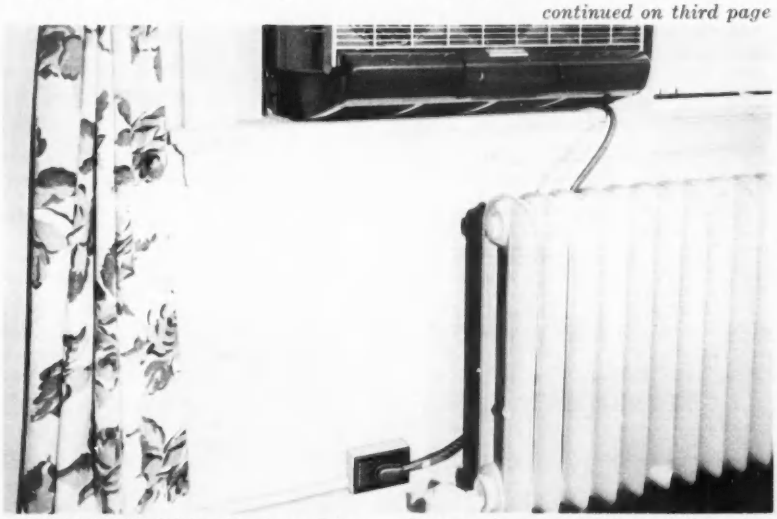


COOL SAVINGS: Wiring for air conditioning is practical and economical with surface metal raceway. This type of installation is readily installed in all buildings.

Code Comments

Partitions and Surface Raceways

Q. *May Wiremold be run through partitions?*

A. Wiremold is permitted to run through partitions, walls, and floors providing they are dry partitions or floors and the lengths of raceway are unbroken where they are passing through. There are certain fittings that are designed for this type of service. For example, the 2017TC allows Plugmold 2000 to be run around the outside of a building passing through the partitions with a length of Plugmold® taking off from the exterior perimeter run and going at right angles to this run down a center partition. This is covered in Section 352-5 and 353-3 of the Code.

General Lighting Load

Q. *What is the basis for calculating the expected branch circuit general lighting load?*

A. In the absence of specific information as to what is intended, the load may be calculated on the "watts per sq. ft." basis as shown in Article 220-2(a)(1).

Fixture Canopy for Fluorescents

Q. *Can backplates both round and rectangular be used as grounding plates when 5738F grounding box for fluorescent fixtures won't fit inside canopy?*

A. It is generally good practice to use such a backplate to ground the raceway's system, and as long as the fixture canopy completely covers the area, a workmanlike job can be done. See Section 410-12.

WIREMOLD®

Advertisement

Editorial

Raceways and air conditioners

With the first day of spring behind us, the promise of air conditioning installation business is at hand.

Such business offers the contractor an important opportunity to demonstrate his awareness of his customers' problems and thus gain higher regard for his services.

Few places are able to close up completely during the installation of air conditioning equipment. Since most of the business is in existing buildings — such as hotels, office buildings and institutions — it is necessary that the installation disturb the occupants as little as possible.

Experience shows that the most practical way to do this is by using surface metal raceways. Not only do they permit faster and neater installations, they open the door for selling-up the job.

Product of the Month

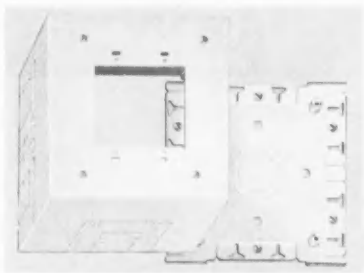
Extra deep box for heavy-duty devices

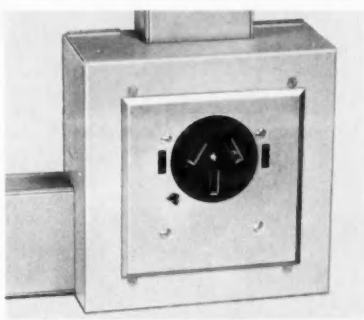
The 3044-2 Extra Deep Switch and Receptacle Box increases the versatility of Wiremold 3000 raceway by making it possible to flush-mount standard 30, 50 or 60-amp receptacles.

Measuring 6⅜ x 6⅜ x 2¾ in., the 3044-2 has plenty of space for making connections and accommodates the maximum wire capacities of 3000.

The box is provided with a rectangular 3¼ x 2⅞ in. holecut in the cover to fit the required switch or receptacle.

Positioning of twistouts on four sides provides added versatility and permits running of raceway either in a straight line or at right angles. Two sides of the cover have one set of combination twistouts for 3000 and 2100 and the other sides have two sets.





Quiz Corner

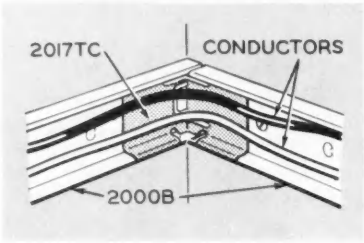
Questions for this department are taken from inquiries received from the field. Your questions are welcome; indeed, they are necessary if this department is to serve you with worthwhile information. Address:

Quiz Corner
The Wiremold Company
Hartford 10, Conn.

Q. *How can I prevent having cracks beneath 2200 Plugmold when mounting it as a baseboard over concrete floor covered with asphalt tile?*

A. Mount the 2200 as tight to the floor as possible before the tile is put down. Tile is cut to fit to the 2200 instead of under it. The thickness of the tile will usually cover cracks due to unevenness in concrete. Cover of 2200 can be easily removed, if it becomes necessary, without interfering with the tile.

Q. *You have two internal elbows for 2000 Plugmold. Is there any type of installation where one must be used and the other cannot?*



A. Choice of which elbow to be used is a matter of preference. The 2017 requires fastening. The 2017TC does not. The 2017TC will work much better in corners that are not true 90's. The cost of the 2017TC is less than one-quarter the cost of the 2017 and usually results in a faster and neater installation. Also, with the 2017TC, the raceway cover serves as the elbow cover with no overlap.

Q. *Can you suggest a simple method of showing a customer how Plugmold will look when installed?*

A. Wiremold's new folder (Form 637) is provided with strips of Plugmold 3000, 2200, 2100, 2000, in both gray and buff finish. These strips may be detached from the folder and placed in position. Check coupon below for a copy.

WIREMOLD®

WIREMOLD ■ HARTFORD 10, CONN. E2-4

Gentlemen: Please send free the checked items

NAME _____

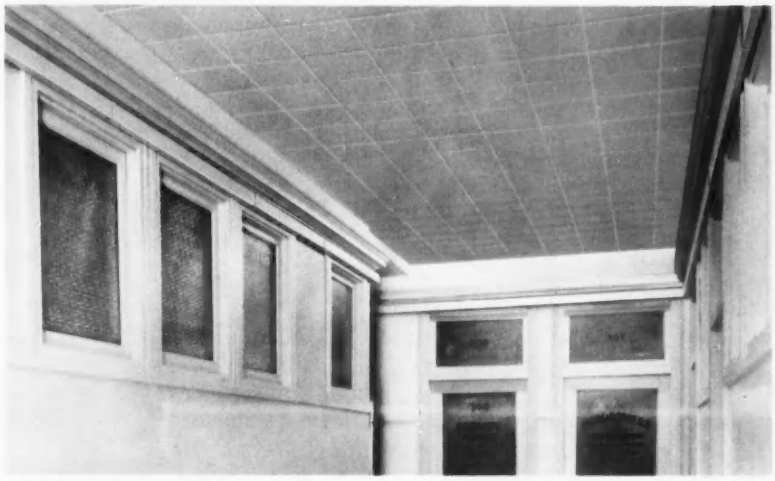
COMPANY _____

ADDRESS _____

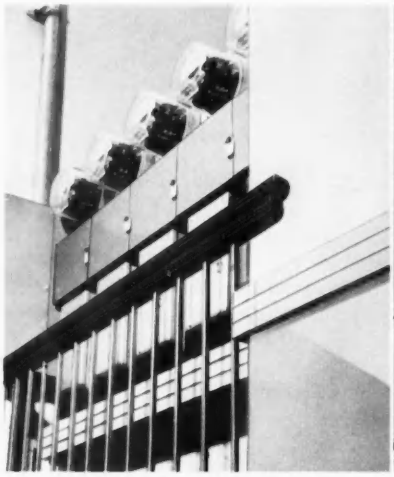
- ☐ Form 637
- ☐ Electric Ideas, March 1962
- ☐ Electric Ideas, February 1962
- ☐ Wiring Guide (Catalog 22)

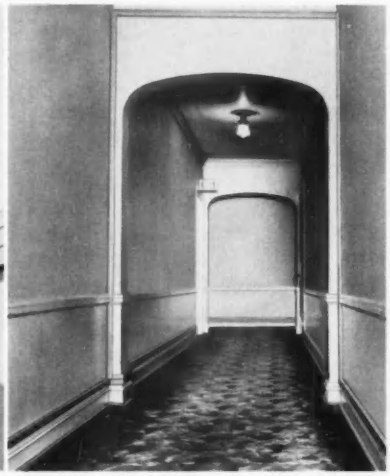
Advertisement

Air Conditioning Wiring Simplified *continued from first page*

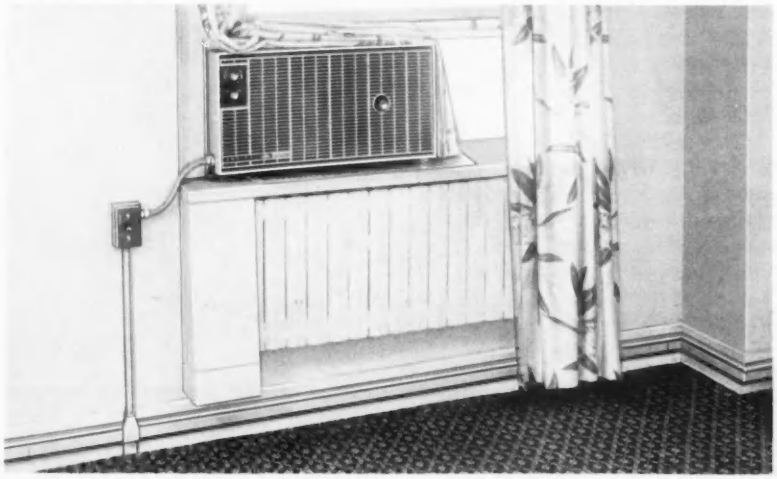


OFFICES: Wiremold 3000 installed in the corridors of this office building serves as a branch circuit feeder for individual office air conditioning units.





APARTMENTS: The rapid increase in air conditioning load necessitated rewiring this Chicago apartment house. Wiremold offered the most — from the viewpoint of capacity, economy and appearance. Note how raceway blends with corridor decor.



HOTELS: Room unit in this Boston hotel is wired directly to the Wiremold switch box by flexible conduit. Wiremold 700 and 2100 were used for room wiring.

finished to match the decor of the different rooms and halls.

Result—an attractive installation completed with little fuss or disturbance to the hotel's guests.

Surface metal raceway was similarly installed in an old nine-story office building to carry conductors for air conditioners. In this instance, feeder risers were installed to new distribution panels. Branch circuits were extended from the panels down the corridors to each location where a room air conditioner was to be installed. Here, the circuit was nippled through the back of the run of 3000 into a 5719D Corner Box and then extended in Wiremold 500 and 700 to the various outlets provided for the air conditioning units.

Result—office personnel were uninterrupted by the construction work going on in their midst.

Finally, consider the same problem, but this time involving an apartment building in Chicago. Economy was the determining factor in selecting Wiremold. The owner wasn't so much concerned with disturbing the tenants, but he realized the cost of rewiring with a concealed conduit system was prohibitive.

The construction progressed in this fashion: No. 8 conductors were brought from distribution panels on each floor and run in Wiremold 3000 along the corridor above the molding and then fed through the wall into Wiremold 2100 inside the room. From six to nine 220-volt units were fed from each pair of No. 8 conductors. The 3000 in the corridor provides plenty of extra capacity to serve other tenants who may want to install air conditioning units in future years.

Result — an installation that saved money for the owner and at the same time has the capacity for air conditioners that may be added later.

Gone are the days when a building has to be considered outdated because it lacks the necessary facilities to handle increased electrical loads. Surface metal raceways provide a speedy, economical and neat method of rewiring that blends with any background.

WIREMOLD®

Engineered Specials

Special 2100 strip for carrier-current cabinets

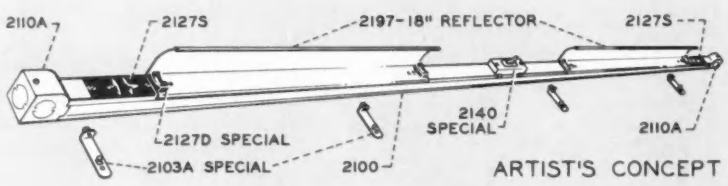
PROBLEM:
To provide a light and power source for maintaining FM single frequency telephone equipment, mounted in carrier-current cabinets.

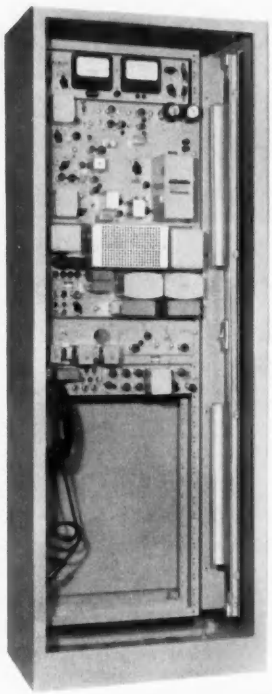
SOLUTION:
A 6-ft. strip of 2100 was prepared which contained the needed lumiline fixtures and outlets.

DISCUSSION:
Lack of lighting and receptacles hampered the testing and maintenance of equipment mounted in metal cabinets. For efficient use, adequate lighting was needed, as well as outlets for power tools.

A special 2100 strip was fabricated equipped with two 18-in. lumiline lamps, two 2127S T-slot receptacles, and a special 2140 switch.

Wiremold engineers gladly modify existing products to meet special design requirements.





Noteworthy

Personnel at Meetings

Ambrose J. Massey, Chicago, will be at the Industrial Electrical Exposition, Wisconsin Electric Power Company Auditorium, Milwaukee, May 2-3, while Ken and Bob Hill, both of Elmira, and Dick French, Philadelphia, share honors at the 27th Annual Convention of the Pennsylvania Society of Professional Engineers, Hotel Hershey, Hershey, Pa., May 10-12.

Ambrose J. Massey

Ken Hill

Bob Hill

Dick French

Practical Tips

Wiremold shears speed cutting of base and cover

Wiremold shears save up to one-third the time normally spent to cut Wiremold 2000 and 2200 base and cover sections.

With this powerful, heavy-duty tool, it takes only a moment to cut raceway.

Two shears are available — the 620 for the 2000 and the 622 for cutting 2200. Both are furnished with a detachable 30-in. long handle, for easy storage and carrying.

The shears come attached to a wood block for easy, portable use or, with block removed, the shears may be bench-mounted.

To operate the tool, merely insert the cover or base of the raceway in the proper place and with the handle as a lever, make the desired cut. A quick motion assures a clean and neat cut without any distortion of the metal.

As easy to use as a paper cutter, the lightweight shears save time and money. The shears, of course, eliminate tedious and inaccurate cutting with a hacksaw.

A clean, burr-free cut every time is assured with Wiremold shears.

WIREMOLD®
HARTFORD 10, CONNECTICUT
In Canada: Conduits National Co., Ltd.
Toronto 2, Ontario

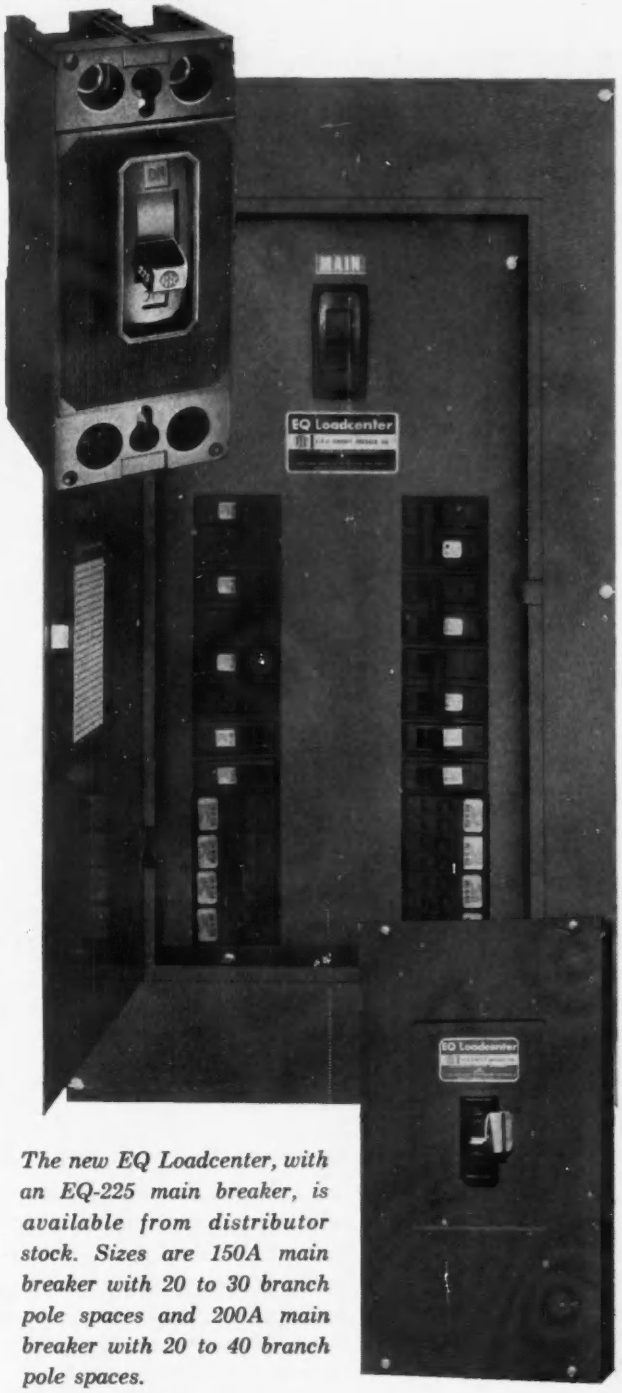
All WIREMOLD products are sold through electrical distributors — your best source for all electrical products.

Advertisement

NEW EQ®-225 AMP. BREAKER

SAME FAMOUS I-T-E QUALITY

New EQ-225 AMP BREAKER
2 POLE 120/240 VOLTS A-C
125-225 AMPERES

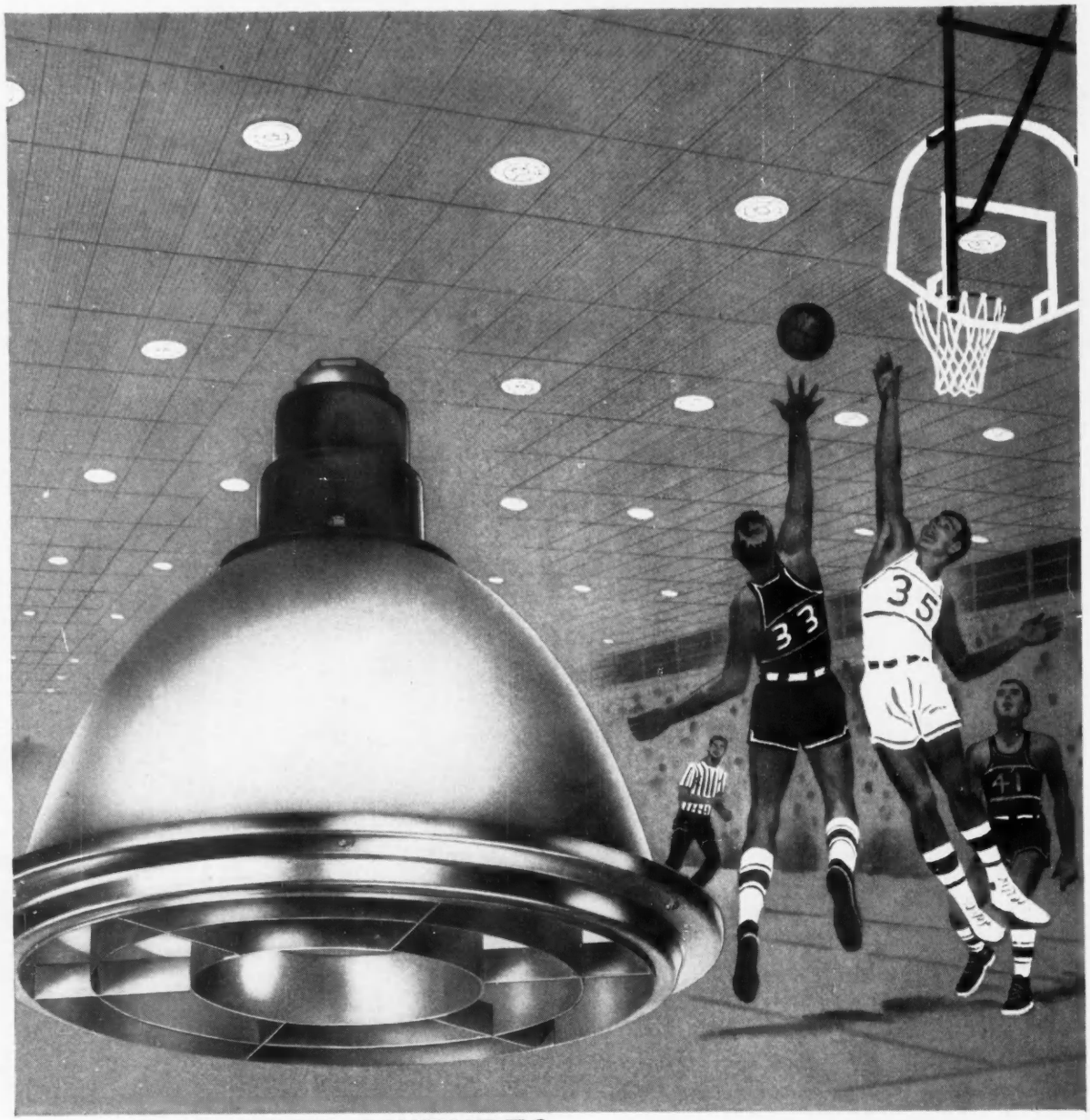


The new EQ Loadcenter, with an EQ-225 main breaker, is available from distributor stock. Sizes are 150A main breaker with 20 to 30 branch pole spaces and 200A main breaker with 20 to 40 branch pole spaces.

Now available under the I-T-E label are the new EQ-225 circuit breaker, new EQ-Loadcenter with 150A or 200A main breaker, and enclosed EQ-225 breakers . . (NEMA Type 1, 1B and 3) . . in ratings of 125, 150, 200 or 225 amperes. These new modern, compact devices provide positive protection against overload or short circuit conditions. The EQ-225 employs Quick-make, Quick-break, Trip-free mechanism action with common trip (not companion trip). A fault to ground automatically opens both poles of the breaker! Overcurrent protection combines the time proven thermal magnetic principle for positive protection against overload or fault conditions. For additional information, contact your nearest I-T-E District Office, or your local I-T-E Authorized Distributor.

for the Contractor who is Proud of his work

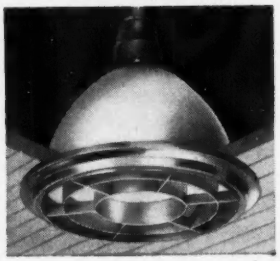
I-T-E CIRCUIT BREAKER COMPANY



RECESSED FIXTURES PUT SPORTS IN A NEW LIGHT

Down with unsightly girders. Up with lighting fixtures mounted flush with the ceiling. This is the new, modern look for gyms, sports arenas and auditoriums made possible by Abolite recessed fixtures. They're made of light, sturdy non-breakable Alzak aluminum. Protected by concentric louvers which provide deep 40° shielding, eliminate glare for players and spectators. Large center opening permits bulb replacement from the floor with a pole re-lamper. These easy-to-install recessed fixtures come complete with plaster rings, finish rings and screws. Available in 18″ diameter for 400 watt mercury lamps, and 14″, 16″ and 18″ sizes for 300-1500 watt incandescent lamps.

To put sports in a new, modern light, get complete information on the Abolite line of gym fixtures. Our catalog is yours for the asking.



ABOLITE *Lighting*

THE JONES METAL PRODUCTS COMPANY
West Lafayette, Ohio

PROTECTED BY STEEL !

Covers of steel guard the circuit breakers from damage in Frank Adam distribution panelboards and switchboards. Furnished as *standard equipment without extra cost,* the added steel armor protecting this better built equipment makes it a standout for tailored appearance as well as safety and rugged durability.

To get this important plus in circuit breaker distribution panelboards, order Frank Adam Type CDP — another industry "Best Buy."

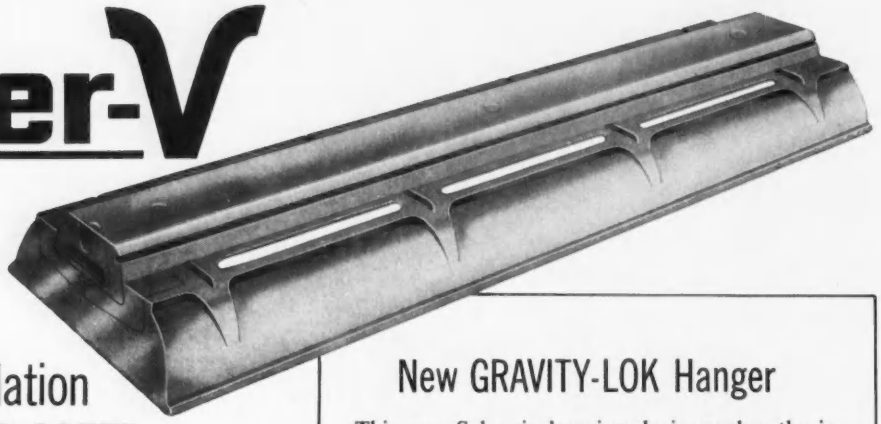
FRANK ADAM CIRCUIT BREAKER DISTRIBUTION PANELBOARDS

Main Capacities: 200 to 1200 amps.
Branches: "E" thru "MA" frame breakers, 15 to 800 amps.

FRANK ADAM ELECTRIC COMPANY
SINCE 1891
P. O. BOX 357, MAIN P. O. • ST. LOUIS 66, MO.

busduct • panelboards • switchboards • service equipment
safety switches • load centers • Quikheter

Sylvania's New Power-V Series



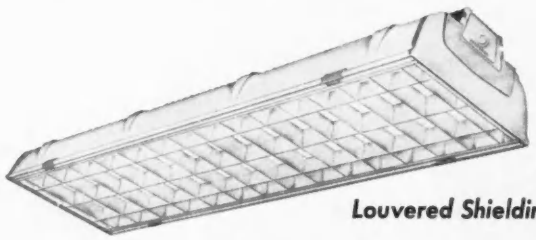
makes your Lighting Installation EASIER-FASTER-SAFER

Sylvania's new Power-V Series has been designed and built with you in mind . . . to provide money-saving methods of reducing installation time.

This, plus the built-in features of ruggedness, neatness, power, versatility and simplicity, make Sylvania Power-V the outstanding line of industrial fixtures available.

Ask your Sylvania representative or your Sylvania Select Distributor for details. Or write to:

SYLVANIA LIGHTING PRODUCTS
A Division of SYLVANIA ELECTRIC PRODUCTS INC.
One 48th Street, Wheeling, West Virginia



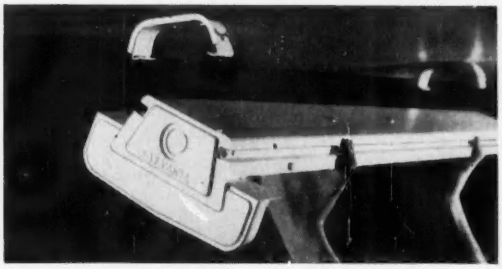
Louvered Shielding

A variety of louvered, lens and panel shieldings can be used with Sylvania's Power-V Series. The door frame (which can swing down from either side) holds the shielding firmly in position to withstand sudden jars or shocks.

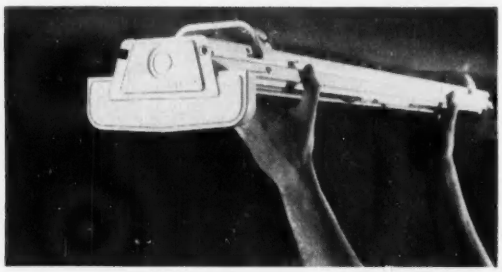
The Power-V with 800 ma HO or 1500 ma lamps and 30° x 30° metal cell louver shielding is gaining popularity for the general illumination of areas where more critical visual tasks are performed.

New GRAVITY-LOK Hanger

This new Sylvania hanging device makes the installation of Power-V fixtures as simple as 1-2-3. Ask for a demonstration in your own office.



After Gravity-Lok Hanger is fastened or suspended, engage groove of one side of fixture channel into lip of stationary side of Gravity-Lok Hanger.



Rotate fixture into position. Movable clamp of Gravity-Lok Hanger moves aside as channel is pushed upward. Clamp then falls into groove on channel holding it in place. Then tighten screw on side of Gravity-Lok Hanger to prevent lengthwise movement of channel, when desirable.

LIGHTING FIXTURES BY

SYLVANIA

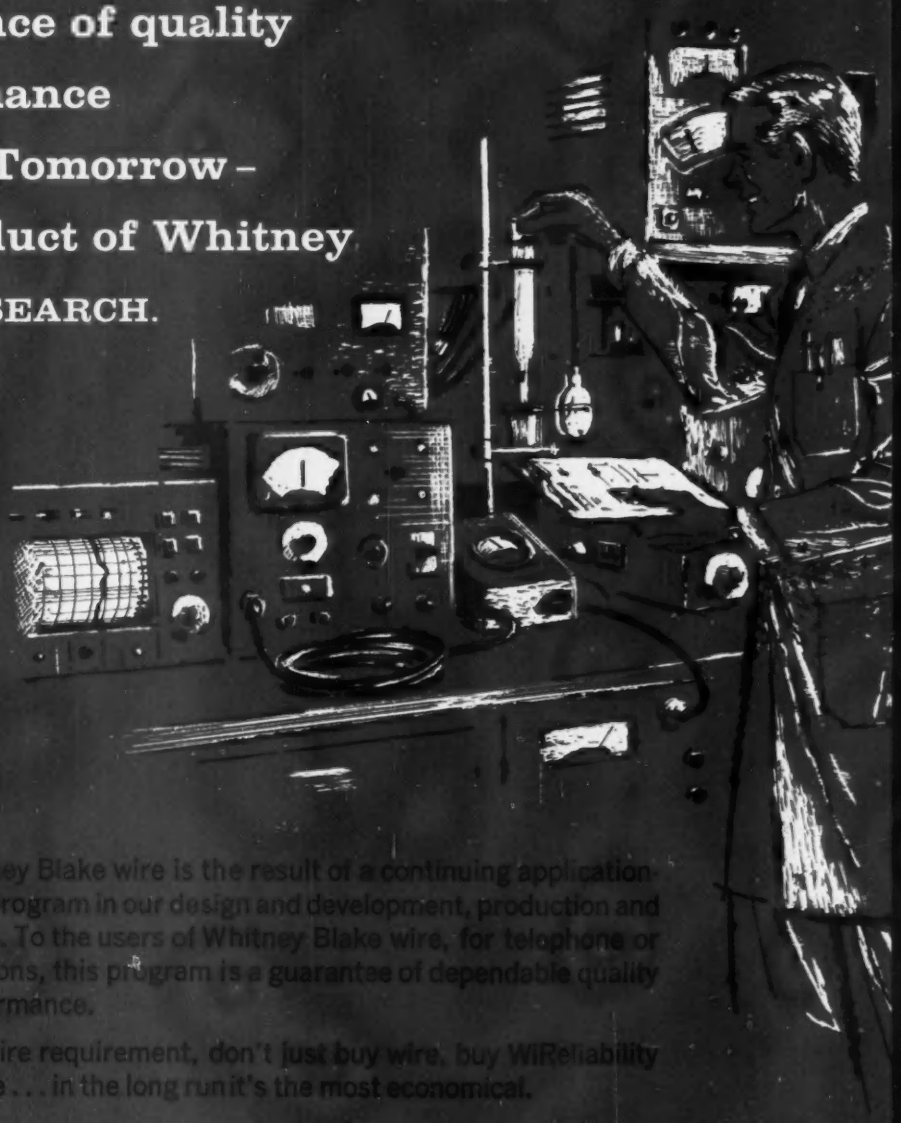
SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS

GENERAL SYSTEM

FROM WHITNEY BLAKE

WiRELIABILITY *

* Your assurance of quality wire performance
– Today and Tomorrow –
Another product of Whitney Blake WiRESEARCH.



Every foot of Whitney Blake wire is the result of a continuing application-oriented research program in our design and development, production and quality control labs. To the users of Whitney Blake wire, for telephone or industrial applications, this program is a guarantee of dependable quality and long-life performance.

When you have a wire requirement, don't just buy wire, buy WiReliability from Whitney Blake . . . in the long run it's the most economical.

WB WHITNEY BLAKE CO.

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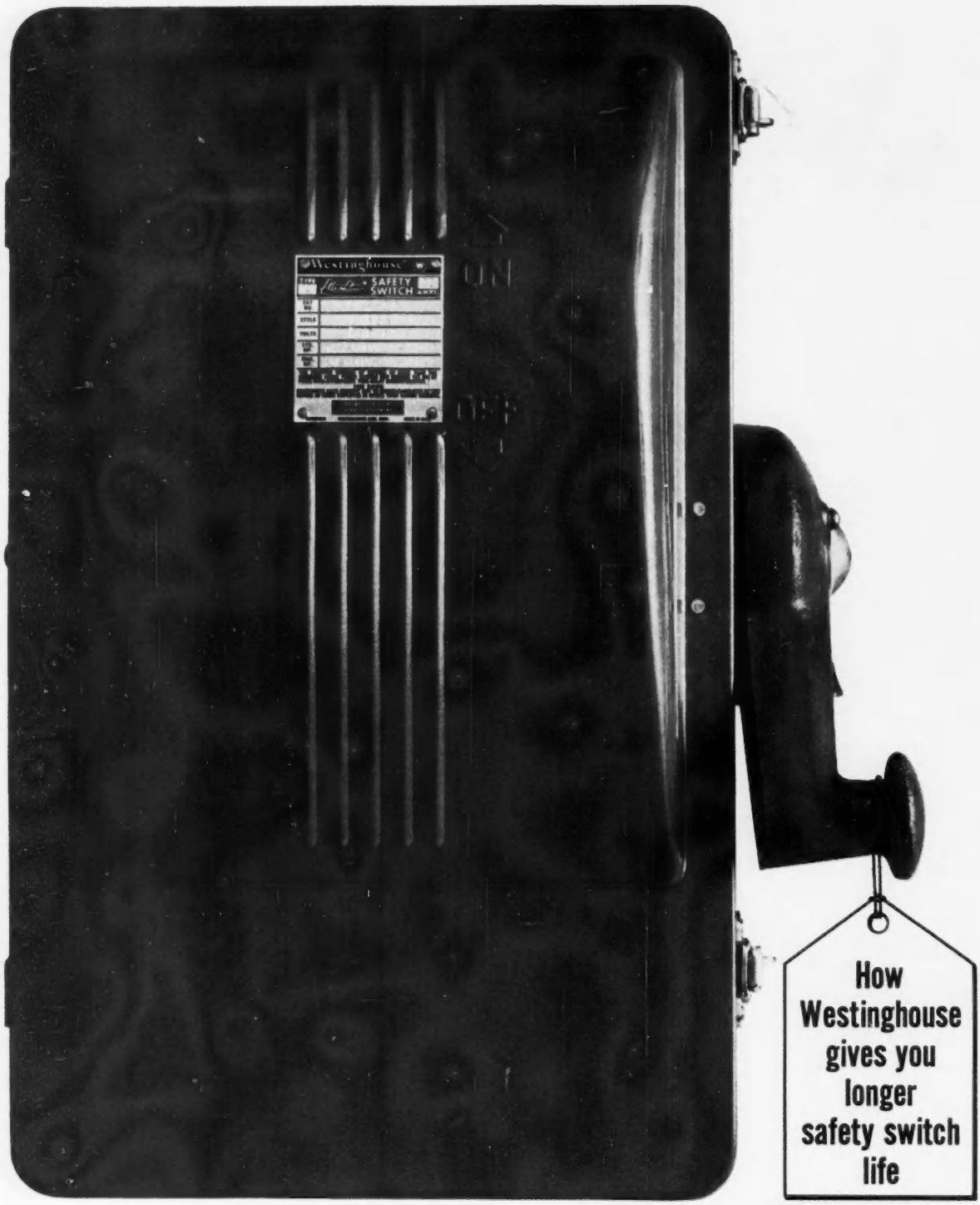


How Westinghouse gives you longer safety switch life

How?—by stopping heat before it starts. An exclusive blade design keeps the arc from the contact area. There's no burning or beading. One-piece copper construction eliminates joint heating. Tin plating stops heat caused by corrosion and wear. Results: the switch stays cooler, lasts longer.

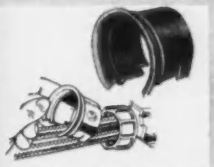
Other valuable Westinghouse features include the De-ion arc quencher and visible blades. These long-lasting safety switches have been tested at 100,000-amp fault currents with current-limiting fuses. Get all the reasons why Westinghouse switches are preferred for rugged applications. Ask your local Westinghouse distributor or salesman for information, or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pennsylvania. *You can be sure . . . if it's Westinghouse.* J-30335

Westinghouse

Women Prefer Men . . .

. . .Who use T&B products — they come home alert and fresh — and with good reasons.

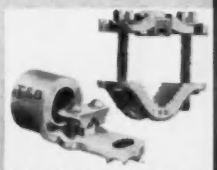
We really can't promise that you'll turn into a Rudolph Valentino overnight by using our products — (if you do, please call us collect) but, we can guarantee that you'll lower your installed costs by saving time on the job.



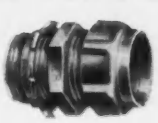
INSULINER SLEEVES* — Ideal for rework . . . Insulates bushings without disconnecting wires — meets NEC 373-6(b), conduit size range from ½" to 6".

GROUNDING WEDGES* — Saves big money on rework . . . grounds box to conduit without disconnecting wires, meets NEC 250-72-E, conduit size range ½" to 6".

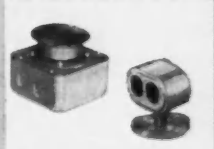
INTERLOCKING ARMORED CABLE FITTINGS — One basic double clamp accommodates 27 different terminations. It can ground, support and hang entire cable systems . . . without ladders or racks.



GROUND FITTINGS* — 25 custom fittings from 8 standard parts can be made with T&B pipe clamp and conduit hub. Accommodates ½" to 1¼" conduit, #8-#2 ground wire.



INSULATED FITTINGS* have bright blue acid resistant nylon lining entire throat. Meets NEC 373-6 for protection of ungrounded conductors — makes wire pulling easier.



FLOOR BOXES AND OUTLETS* — New concrete tight "Reddy-tilt" has 13 knockouts, ½" to 1¼" — levels 10° in any direction, adjusts ⅝" vertically. New Duplex outlet accommodates any standard receptacle.

*

With the increase in "modernization wiring" you'll profit by using the T&B lowest installed cost approach for updating electrical installations. Our authorized distributors have them in stock right in your area.

For complete product information, write the Thomas & Betts Co., Elizabeth 1, New Jersey. In Canada, Thomas & Betts Ltd., Montreal . . . we'll send it immediately.

T&B ENGINEERED **THOMAS & BETTS**

How would you get at the stuff in front

Does your pick-up keep things from you?

Do you still have to unload the stuff in the rear, and then the stuff in the middle, to get at something in front?

Our Volkswagen would never make you do that. Our sides get out of your way.

All 3 sides drop on the VW. Like tailgates. You load it like a flatbed.

You work with a clear deck, 5 feet wide and 8½ feet long. It's 2½ feet longer than a standard half-ton.

And it's all flat. No wheel well.

You can carry 1,764 lbs. on our deck with no strain. Some owners even carry light tractors on it.

If it rains, you can get hoops and a tarp that turn the VW Pick-Up into a kind of covered wagon. (These are extra.)

© 1962 VOLKSWAGEN OF AMERICA, INC. †SUGGESTED RETAIL PRICE, EAST COAST P. O. E.: $1,995 WEST COAST.

if the sides didn't come down?

There's also a weatherproof locker 4 feet long and 5 feet wide under the bed. You can store tools there at night.

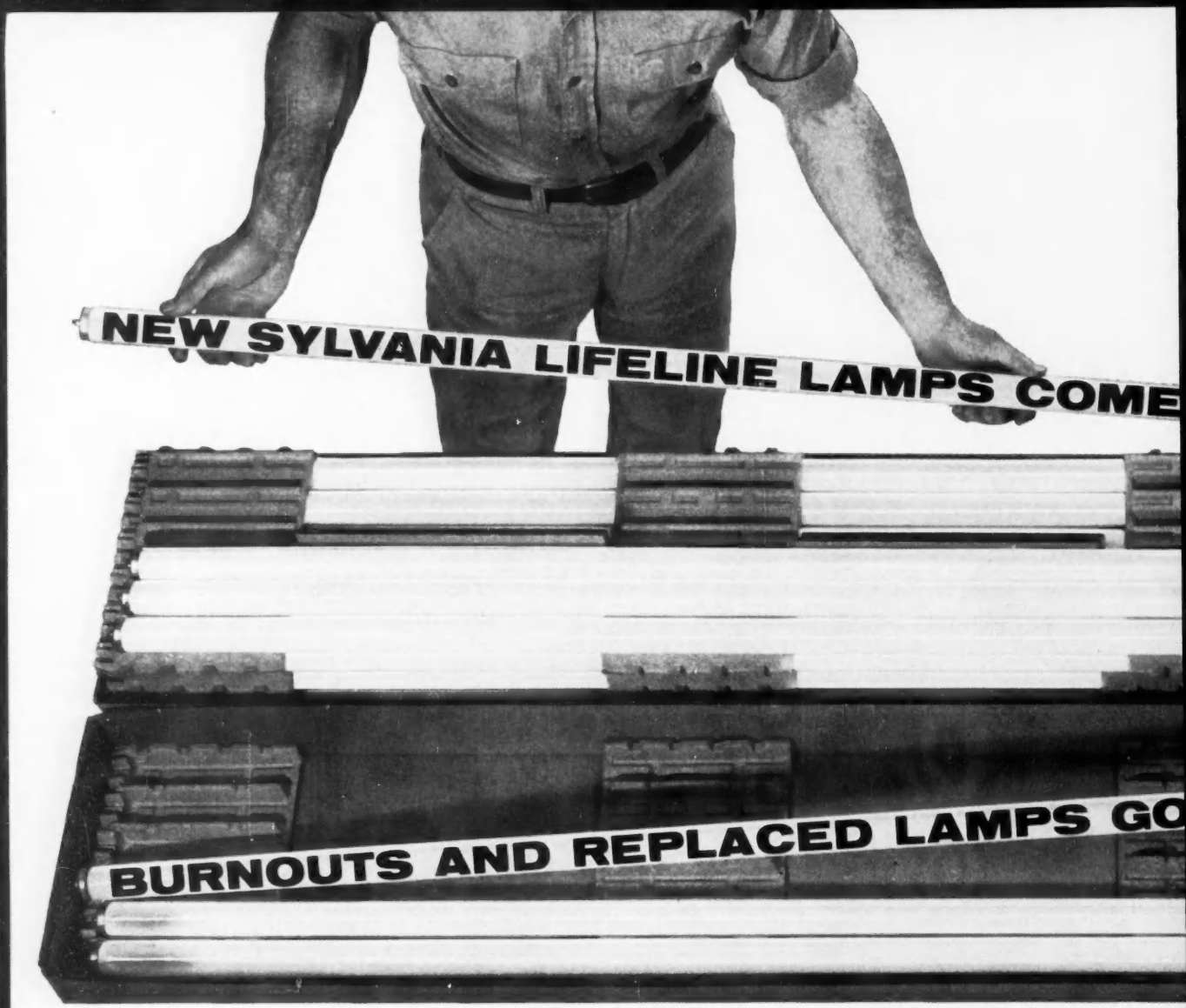
The VW Pick-Up is built a little differently from most others. For one thing, its body is welded into practically a solid hunk of steel. No bolts to loosen or rattle.

For another, its engine's in the rear. You get traction in mud, sand and snow. And it won't ever boil over or freeze up. It's air-cooled.

Up on deck and down in the engine room our pick-up has little ideas for helping you that other pick-ups haven't quite caught up with yet.

One of the littlest is the price.

$1,885.†



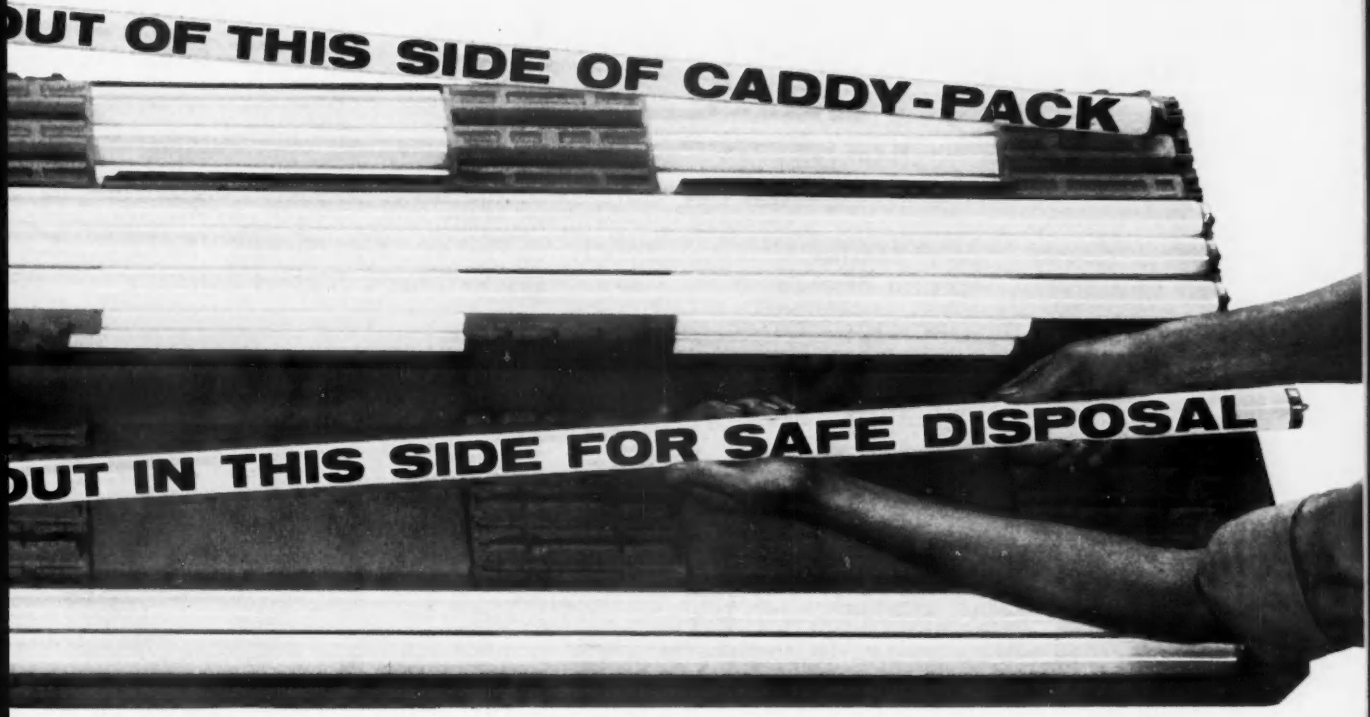
Now there's an 8-foot
(Could group relamping

Above you see another great moneysaving idea from Sylvania. An 8-foot Caddy-Pack that lets you move 24 new Lifeline lamps into the lighting area safely, conveniently – and lets you take out 24 replaced lamps in the same container!

This is the 8-foot version of Caddy-Pack, the greatest efficiency unit ever designed for group relamping. The 4-foot unit you see in the sketch at the side has already been introduced and has revolutionized fluorescent relamping. 4-footer contains 60 lamps. Same principle. Only difference is 8-footer lies flat, 4-footer stands up.

And now in both you get sensational new Sylvania 9000-hour Lifeline fluorescents—each with an exclusive etch on glass for recording date of installation.

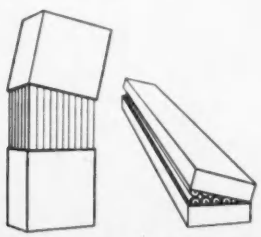
These are just two more examples of how Sylvania keeps working to solve your own lighting problems realistically. To bring you the lowest possible TCL—Total Cost of Lighting. With moneysaving methods. Brighter, longer-lasting lamps. And an exclusive Sylvania money-back guarantee that states: "If at any time a Sylvania Fluorescent Lamp fails in your opinion to provide better performance than any other brand fluorescent lamps, on the basis of uniformity of performance, uniformity of appearance, maintained brightness and life, it may be



Sylvania Caddy-Pack!

be easier than this?)

returned to the supplier for full refund of purchase price." Now, make your group relamping faster, safer, more economical. See your Sylvania representative for Caddy-Packs. Or write: Lighting Division, Sylvania Electric Products Inc., Dept 15, 60 Boston St., Salem, Mass. In Canada: Sylvania Electric (Canada) Ltd., Montreal.



4-FOOT CADDY-PACK 8-FOOT CADDY-PACK

SYLVANIA

SUBSIDIARY OF

GENERAL TELEPHONE & ELECTRONICS

GENERAL SYSTEM

Why Westinghouse is first in circuit breakers

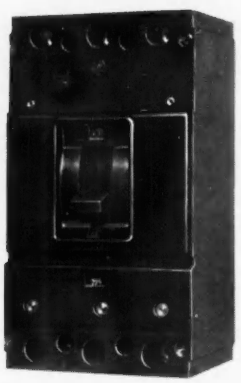
In 1924 Westinghouse applied for the original patent on the trip-free mechanism for AB molded case circuit breakers

Since 1924 Westinghouse has continued improving the circuit breaker, with more improvements coming all the time

Since inventing the original AB molded case circuit breaker, Westinghouse has continued to earn scores of basic patents for circuit breaker developments. Each, in some way, has made today's Westinghouse circuit breaker a greater value. Present developments will make tomorrow's breaker even better.

These continued improvements have made Westinghouse AB De-Ion breakers the industry's most widely accepted breaker with designers, manufacturing engineers, contractors and others. Ask your local sales representative to show you how the full line of quality Westinghouse breakers can build more reliability into your electrical systems, or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pennsylvania. *You can be sure . . . if it's Westinghouse.*

J-30939



Westinghouse

THE ROYAL FAMILY OF

WEATHERPROOF DEVICES . . .

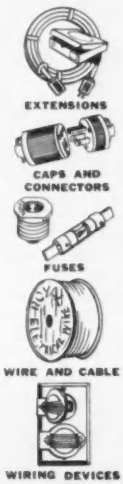
QUALITY YOU CAN MEASURE IN TIME!

Why time? Because Royal weatherproof electrical devices install faster and last longer. Here are two of Royal's time-miser, top quality items:

Weatherproof Edison base sockets in durable vinyl (for car lots, carnivals, showrooms, auctions, etc.). In red, green, brown, black — 660W, 250V.

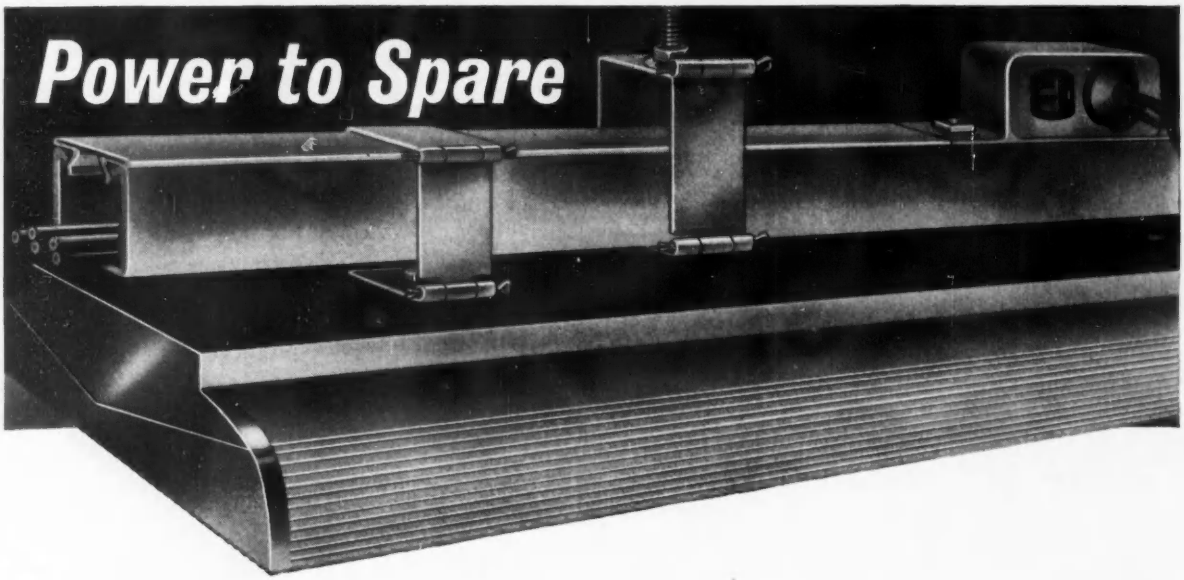
Weatherproof "Sta-Open", "Flip-Tite", and screw cover receptacles and switches . . . also universal single and duplex cover plates for converting standard devices for outdoor duty. Corrosion resistant materials. Positive weather-barrier sealing action.

Next time you visit your electrical wholesaler, ask to see these useful, adaptable devices . . . or write us, giving your wholesaler's name.



ROYAL ELECTRIC
. . . an associate of ITT

ROYAL ELECTRIC CORPORATION
PAWTUCKET, RHODE ISLAND



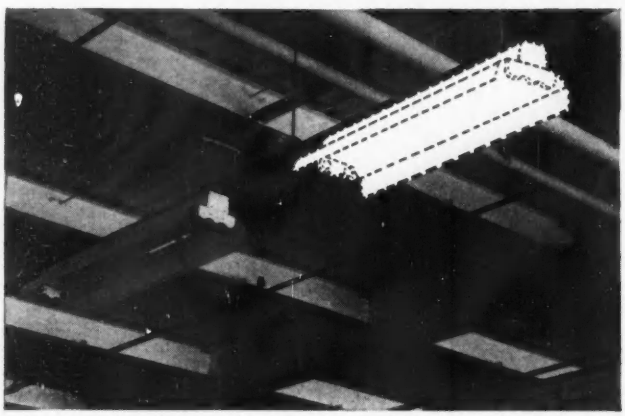
Steel City Channel MOUNTS, HANGS & FEEDS the fixtures

FOR SURFACE OR SUSPENDED LIGHTING

POWER TO SPARE—

A central wiring distribution channel with conductor capacity that exceeds requirements of any lighting layout and with power to spare for other uses. Here's a Channel that adapts to any interval of structural support—may be dropped to any level where it becomes a rigid platform for fixture attachment. Lighting fixtures may be spaced and fastened anywhere along the Channel System.

Branch lighting circuit conductors are completely enclosed in Channel from panel to fixture. This raceway carries full Underwriters' Laboratories, Inc. approval.



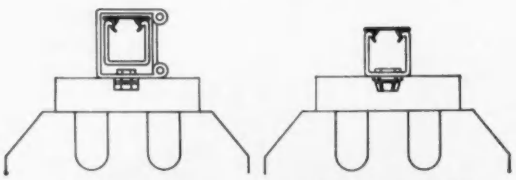
Fixtures may be added or relocated as required. To remove fixture, merely un-plug cord, open sliding fixture hangers and lower fixture. It's that easy.

MONEY SAVING FEATURES . . .

● Eliminates cutting and threading of conduit ● Reduces number of hangers ● Uses existing boxes for wiring feeds ● Plug-in method reduces wiring costs ● The greater hanger spacing allows use of existing boxes with fewer intermediate hangers ● Pre-wiring of long lengths of channel at bench level ● Top mounted receptacles provide outlets for portable tools and machinery.

SURFACE RACEWAY SYSTEMS

LISTED BY UNDERWRITERS' LABORATORIES, INC.



PLUG-IN TYPE DIRECT FEED TYPE

Channels of various depths and gauges, for use as surface raceway wiring systems or for fixture support only, are available as standard.

When used as a raceway, the Channel capacities are more than ample for every lighting requirement—up to ten No. 8 AWG conductors (National Electrical Code).

Write for Free Booklet G-2

Easy removal of fixtures for ballast repair and cleaning reduces maintenance costs.

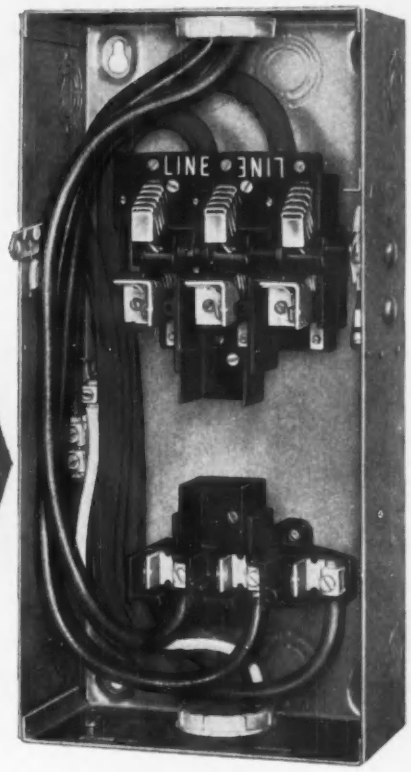
STEEL CITY ELECTRIC COMPANY PITTSBURGH 33, PA.

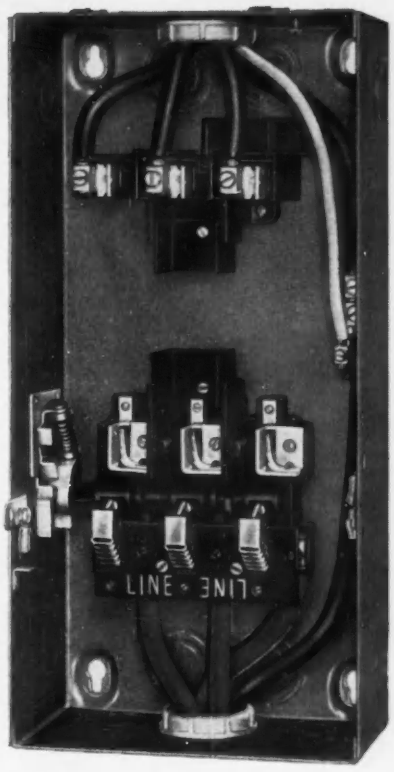
A subsidiary of Martin Marietta Corp.

Save up to $30 on cable cost with new G-E reversible-wiring safety switches

Load

Load





Eliminate upside-down boxes and danger of wire abrasion

Line

Line

Old way wastes wire, work and money. Looped cable inside box presents danger of wire abrasion. None of this is necessary when you use new General Electric reversible-wiring safety switches, 100-amp and above.

New G-E way eliminates danger of wire abrasion, inconvenience of upside-down boxes. ON-OFF indication remains unchanged. Available with line lugs factory-installed at bottom, or for field installation.

SCHEDULE OF SAVINGS ON CONDUCTOR COSTS

Switch Rating	Conductor Size	Amount Saved Per Switch Installed*		Length of Wire Saved (In Feet)	
		2-Pole	3-Pole	2-Pole	3-Pole
100 AMP	2	$ .91	$ 1.36	5	8
200 AMP	3/0	3.73	5.60	9	14
400 AMP/240 VOLT	500 MCM	12.56	18.90	11	16
400 AMP/600 VOLT	500 MCM	13.74	20.60	12	17½
600 AMP/240 VOLT	(2) 350 MCM	18.70	28.10	22	33½
600 AMP/600 VOLT	(2) 350 MCM	20.40	30.60	24	36½

*Based on approximate contractor prices for Type RHW copper building wire.

GENERAL ELECTRIC

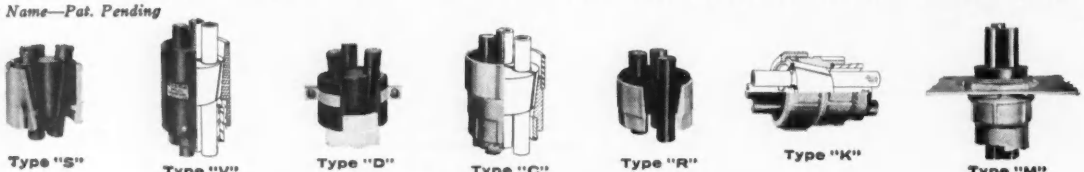
Circuit Protective Devices Dept., Plainville, Conn.

This plug's a workhorse

pOZi-grip*..... O.Z.'s new plug design for all standard cable supports. Thousands of tiny but tough grippers are sealed into a special coating bonded to the plug's grooves. Increased gripping power is constant, even, and positive over the full circumference of the cable. POZI-GRIP plugs surpass all UL requirements.

This is another quality step by O.Z. to bring you the best electrical fittings through a nationwide network of the finest electrical distributors.

** Trade Name—Pat. Pending*



O.Z. ELECTRICAL MANUFACTURING CO., INC.
262 Bond Street • Brooklyn 17, N. Y.

Sales Office and Warehouse: 406 So. Cicero Ave., Chicago 44, Ill. • ES 9-0326 • **Office and Warehouse:** 655 So. Van Ness Ave., San Francisco 2, Calif. • MA 1-4075
Cast Boxes • Cable Terminators • Power Connectors • Solderless Connectors • Grounding Devices • Conduit Fittings • Interlocked Armor Cable Fittings

IN LESS TIME THAN IT TAKES TO READ THIS AD

A Clipper Drill Will Put a 4" Hole Through 6" of Reinforced Concrete! Clipper Core Drills are the world's fastest concrete drills! Fastest because they are the only drills with adequate power necessary for low-cost drilling of any size hole up to 14" in diameter in heavily reinforced concrete . . . prestressed slabs . . . any masonry material ● G.E. designed a 3 H.P. induction type motor exclusively for Clipper drills—and designed it for heavy duty drilling under the most demanding conditions ● This gives Clipper Core Drills superiority in speed and performance over units using converted hand drill motors. AND only Clipper offers speed selection — 300, 800, 1500 RPM — to give you the right speed for every drilling job. Write for complete information or CALL COLLECT to your Clipper Factory Trained Representative. He'll help you select the right Clipper drill for your next job. And he'll show you how to turn your worn out diamond bits into new Clipper Bits — at a savings ● Clipper also manufactures a complete line of masonry and concrete saws and blades. Additional information is yours for the asking.

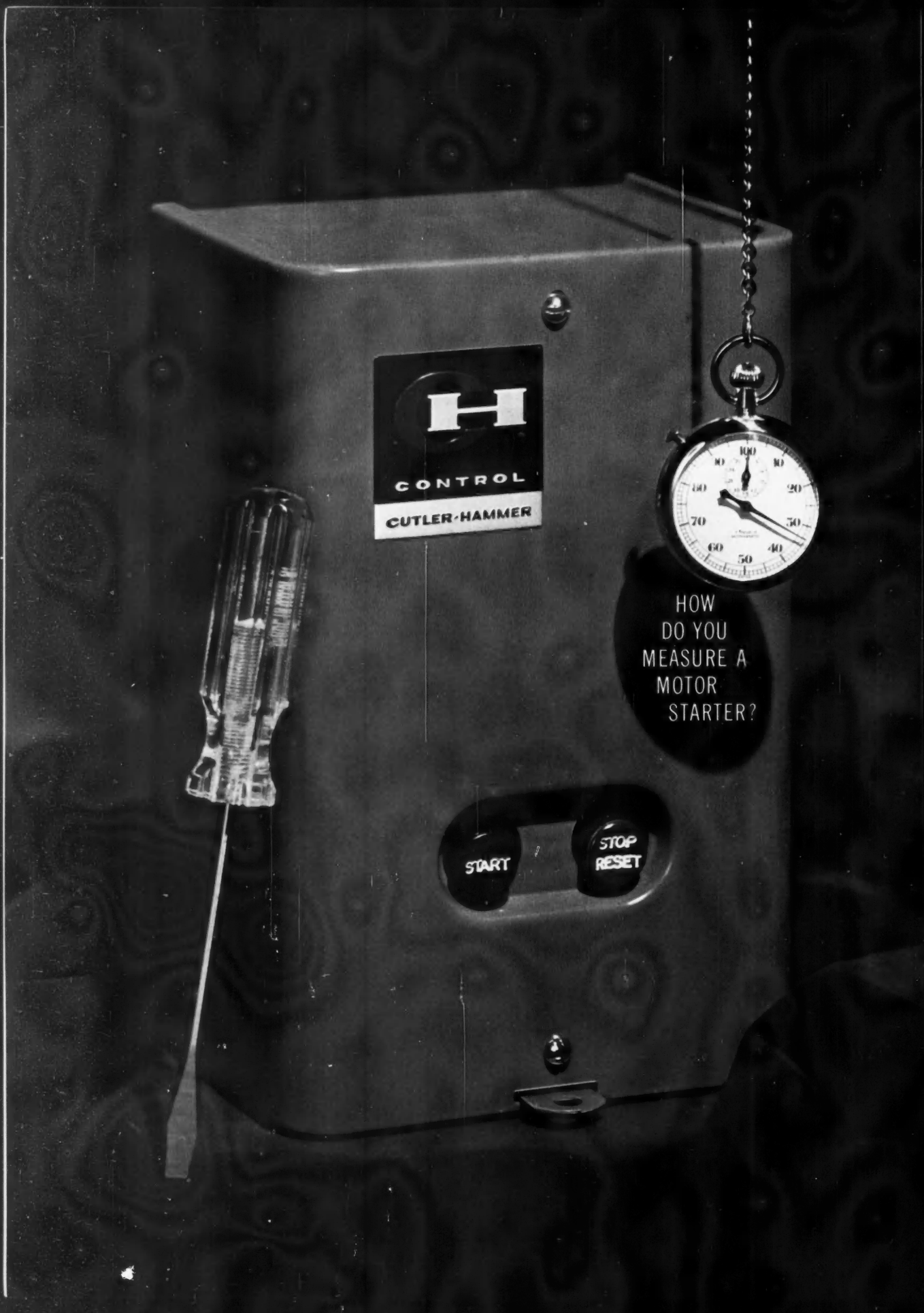
Clipper CUTS RIGHT THRU MANUFACTURING CO.

2801 WARWICK, KANSAS CITY, MISSOURI

Factories: Australia, Brazil, England, France, Germany, Italy, U.S.A.

SOLD DIRECT FROM OFFICES AND WAREHOUSES COAST TO COAST

714X


H
CONTROL
CUTLER-HAMMER
START
STOP
RESET
HOW
DO YOU
MEASURE A
MOTOR
STARTER?

What do contractors say about motor starters?

"We demand top quality product and performance, but our choice is often made on other factors"

Quick installation? It's money in a contractor's pocket. Easy maintenance? One key to a satisfied motor starter customer. Today, nobody will buy a starter that doesn't deliver these important benefits.

And these are qualities that have long been built into all Cutler-Hammer motor starters.

But we've also been aware that certain *non-product* factors are important to a contractor's business. Recently a group of 254 typical and important buyers of motor starters told us how *really* important they consider these non-product measurements. These, they said, determined their choice in many cases:

1. AVAILABILITY

Local stocks are considered a must by buyers. And with Cutler-Hammer, more than 600 distributors maintain balanced stocks. Complete starters or required replacement parts are just a phone call away. They're backed up by 66 district offices and 17 regional warehouses. The 91% of your motor starter requirements that you need in a hurry are available *locally*. Even special requirements can often be handled overnight.

2. SERVICE

Service was the next most-mentioned factor. And you'll find Cutler-Hammer service better than ever. Both the distributor and the Cutler-Hammer man will treat your problem as their own. Together they'll be able to handle your problems—and emergencies—in just hours.

3. COMPLETE PRODUCT LINE

Being able to get the right starter when needed naturally ranks high in importance with buyers. With Cutler-Hammer, you get exactly the starter you need to do the job right. Cutler-Hammer has 10 NEMA sizes, 00 through 8.

For complete details on the starter line designed to industrial standards, proven in thousands of applications and exceeding NEMA requirements in every respect, send for publication LO-70-G241.

So next time you're talking about motor starters . . . talk to Cutler-Hammer. You know the reputation of our products . . . call your nearby Cutler-Hammer distributor and find out about his service!

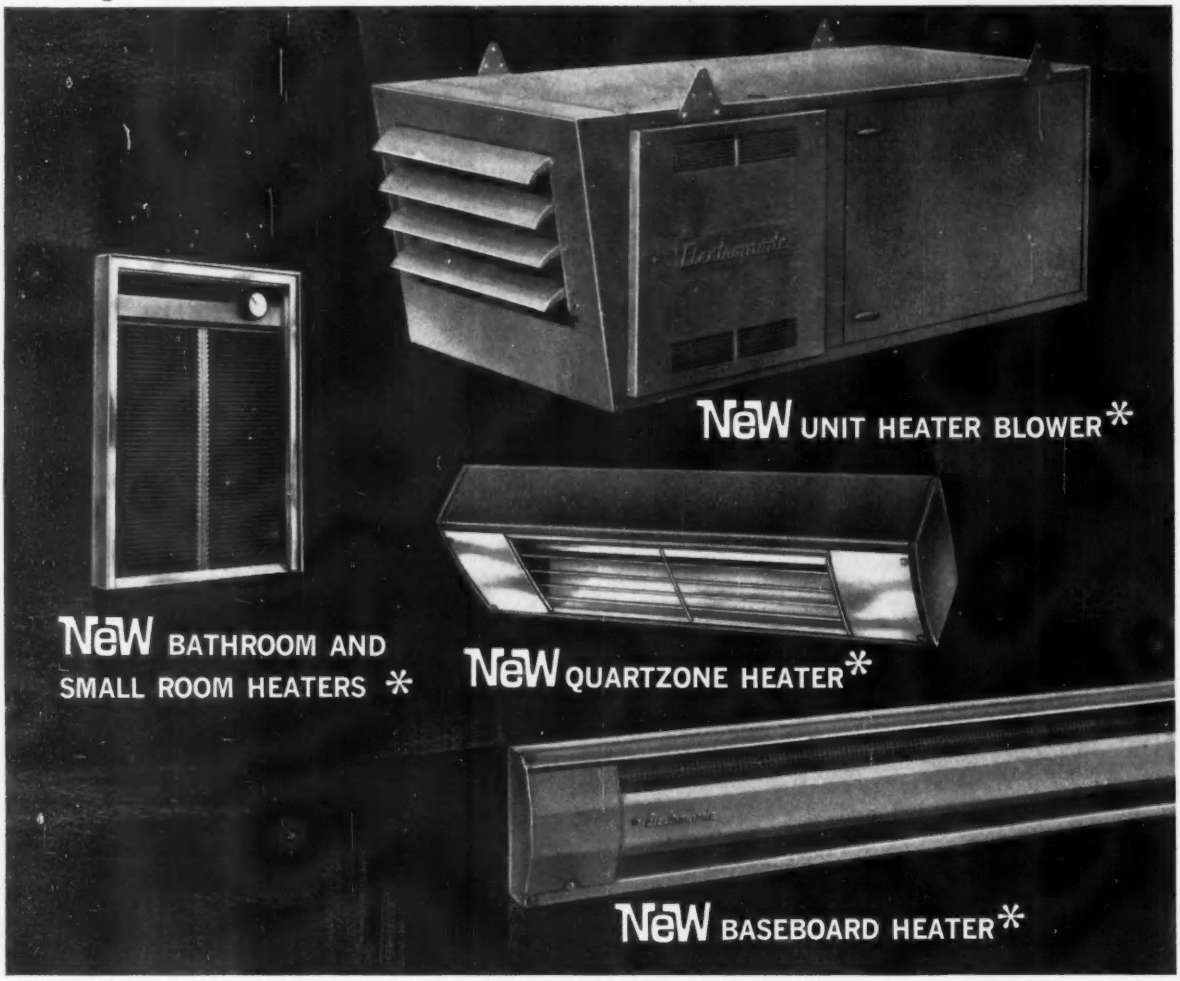
WHAT'S NEW? ASK...

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Divisions: AIL; Mullenbach • Subsidiaries: Uni-Bus, Inc.; Cutler-Hammer International, C.A. • Associates: Cutler-Hammer Canada, Ltd.; Cutler-Hammer Mexicana, S.A.

4 NEW PRODUCTS

Electromode

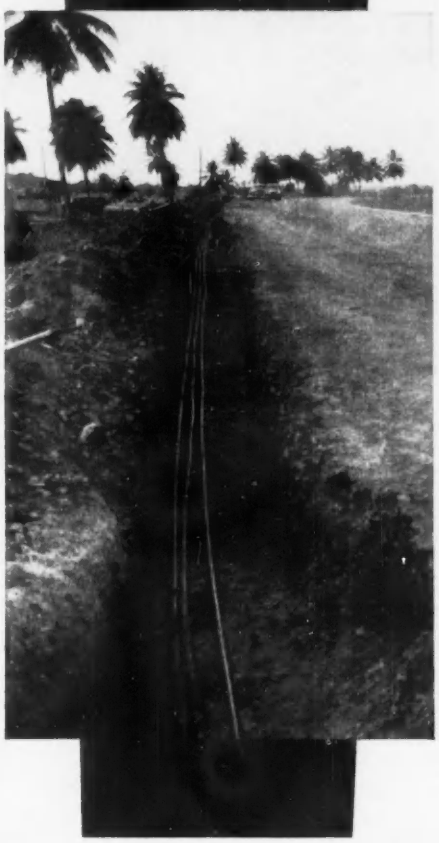


* **NEW BATHROOM and SMALL ROOM HEATERS:** Completely restyled in new Satin Aluminum finish that adds the ultra modern look to any bathroom. Finish has longer life and is anti-corrosive. Automatic, Small Room Heater features fan control mechanism, oil-sealed motor and newest hydraulic type thermostat. * **NEW UNIT HEATER BLOWER:** The most advanced unit of its kind for commercial and industrial use. Precisely engineered for compactness. Quick, versatile installation in a variety of positions. Adjustable louvres conveniently direct heat where most desired. * **NEW QUARTZ-ONE HEATER:** Now equipped with high intensity quart tube which beams near-infrared rays—producing light as well as heat! Now more suitable than ever for exposed area heating, such as loading docks. Perfect for outside store display windows. Especially useful for any high outdoor installation. Pinpoints heat exactly where needed. * **NEW BASEBOARD HEATER:** Extra easy, simplified installation and smart styling of attractive perforated grille are outstanding features of Electromode's newest baseboard. Now completely factory pre-wired and equipped with built-in connection box. Box components are all standard and interchangeable. Installation time is reduced to a bare minimum. Simply remove cover plate and you have easy access to convenient mounting holes.

NEMA

Electromode *Division of Commercial Controls Corp.* **Dept. ECM-42 Rochester 3, New York**

Only one cable
could meet all the requirements
for this 6,000-foot power installation...



SIMPLEX
HIGH VOLTAGE
POLYETHYLENE

INSULATED POWER CABLES

SAN JUAN, PUERTO RICO — When the extension of San Juan's International Airport was proposed recently the Puerto Rico Water Resources Authority — producer of all the Commonwealth's electric power — was asked to remove a one-mile section of overhead transmission cable.

The Authority's primary problem was to switch to an underground installation in the shortest possible time and at the lowest possible cost.

Armored cables were "out" — too expensive. Also unsuitable was any cable which required ducts, concrete trenches or manholes.

The one cable that met *all* requirements — *including lowest cost* — was Simplex 350 MCM copper, 61 strands, polyethylene shielded, Plastex jacketed cable rated at 46KV grounded neutral.

Can Simplex polyethylene-insulated power cables solve some of *your* high voltage problems?

Such properties as low dielectric constant, low power factor, low dielectric loss, high dielectric strength and very high insulation resistance are making polyethylene insulation one of the most important high voltage cable innovations in years. And Simplex is — *by far* — the leader in the research, development and production of polyethylene-insulated high voltage cables. Write today for complete information.

Photo courtesy of Puerto Rico Water Resources Authority.

POLYETHYLENE CABLES BY Simplex WIRE & CABLE CO.

EXECUTIVE OFFICES: Cambridge, Mass. • Plants at Cambridge, Mass., Portsmouth, N. H., Westbury, L. I., Monrovia, Calif.

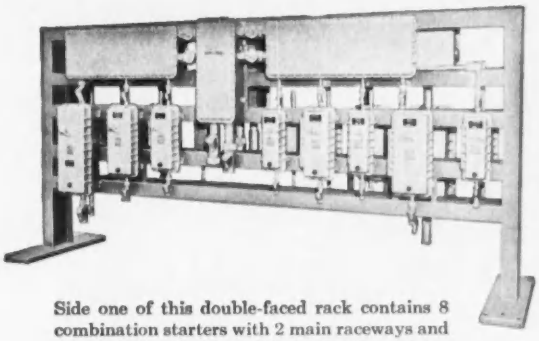
"Are they* delivered ready to install?"

* KILLARK SWITCH RACKS

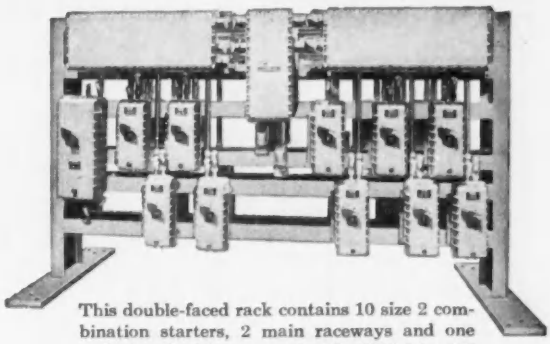
This rack is 20 feet long, 7½ feet high, and weighs 8700 pounds. Side one, shown here, contains 18 combination starters, with wiring through 4 raceways. Main terminal blocks are placed in a junction box. Side two (in back) contains 17 combination starters with terminal box and 4 raceways. Galvanized steel mounting frame is painted with two coats of zinc-rich paint. Built in accordance with N.E.C. Code, Article 500, governing Class 1, Group D, Division 1, hazardous areas.

Killark

ELECTRIC
MANUFACTURING
COMPANY



Side one of this double-faced rack contains 8 combination starters with 2 main raceways and one main terminal box. The back side contains similar equipment. Total estimated weight 4,952 pounds. Length 15′, height 7′10″.



This double-faced rack contains 10 size 2 combination starters, 2 main raceways and one main terminal box on each side. Weight 4,828 pounds, height 7′10″.

"You bet they are! Designed, assembled, wired, sealed, shipped. Ready to hook up to power."

"Les Sparks"

Killark's Bob Grimm, Assistant Sales Manager, is shown on the opposite page, by one of four (front-back) switch racks recently built for a Texas oil refinery. Two others are illustrated above.

All-aluminum control centers are custom-designed by Killark engineers from the broad selection of Killark enclosures: motor starters, disconnect switches, circuit breakers, panel boards.

Killark switch racks offer several really big advantages. Because they're aluminum, they're lightweight, rust-proof, non-sparking. They're versatile; you can specify them as large or small, as simple or complex as you require. They can be built for indoor or outdoor location, for hazardous or non-hazardous environments. All boxes are ribbed for higher strength and faster heat dissipation, rectangular for more compact assembly, front-opening for easier access and servicing.

Killark does practically all the work for you, from blueprints to assembly to wiring to sealing to shipping. The racks arrive at your plant ready to hook up to your power.

If you would like further information about Killark custom-assembled switch racks, drop us a line and we'll be happy to give you complete details.

Vandeventer and Easton Ave. St. Louis 13, Mo.

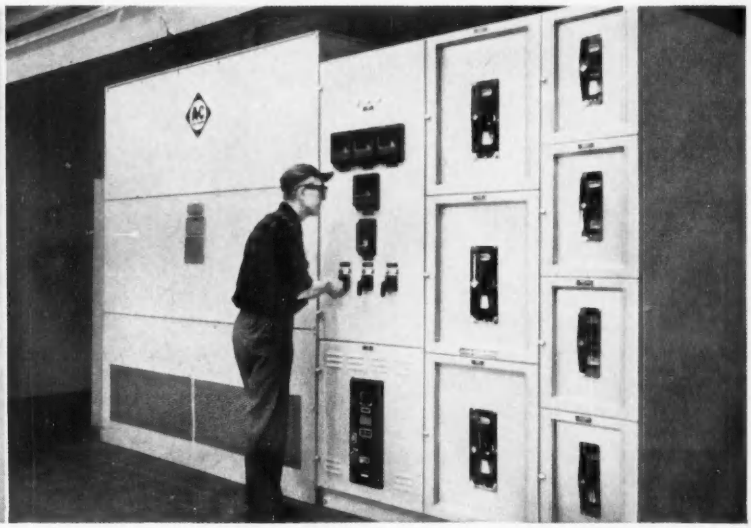
In Canada: Killark Electric of Canada, Ltd., 421 Islington Ave. South, Toronto 18, Ont.

6148

Current news reports

WHAT'S HAPPENING IN ELECTRICAL SERVICES?

Highlights: A new 100-, 50- and 25-kvar capacitor line. A load-break switch that provides complete system and personnel safety. These examples demonstrate the extra value that is standard with Allis-Chalmers...the greater efficiency and added productivity that are yours when you buy A-C products, systems and services. Call your nearby Allis-Chalmers office for details or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-1590



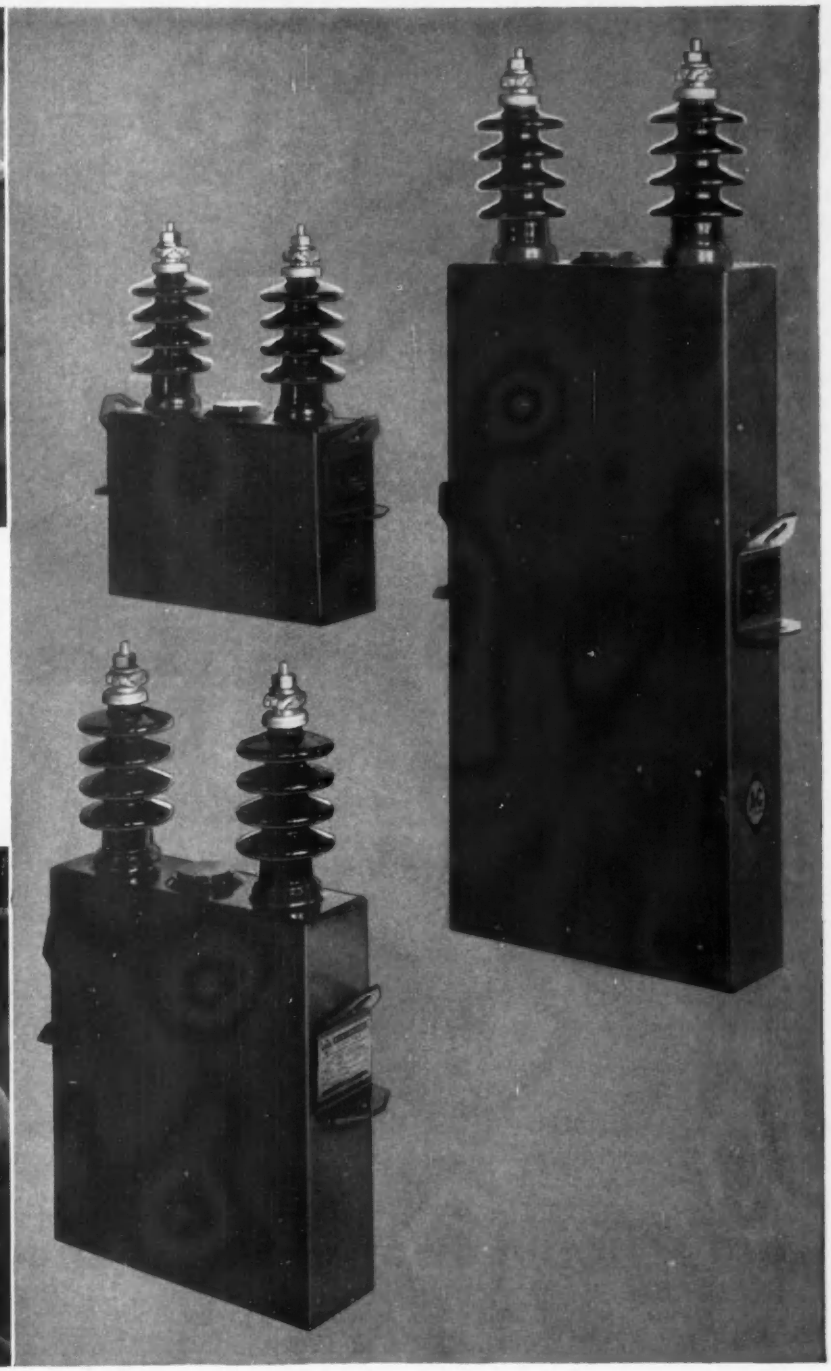
Metal-clad safety for your personnel... A roll-out load-break switch that completely isolates the switch from live current. Fuse changing and switch maintenance handled with maximum safety. The roll-out element cannot be withdrawn or returned to the cubicle with the switch in the closed position.

Load center substations cut costs! Ventilated dry-type transformers require less maintenance. You keep line losses at a minimum by locating substations close to your load centers. Other A-C advantages: a low-voltage breaker compartment that's completely isolated from bus compartment and other breakers; manual or electrical stored-energy closing; LCS units that are preplanned for expansion. Specify A-C substations with dry-type, oil-filled or *Chlorextol*-filled transformers.

Chlorextol, Super-Seal, Poxeal and Vari-Tex are Allis-Chalmers trademarks.

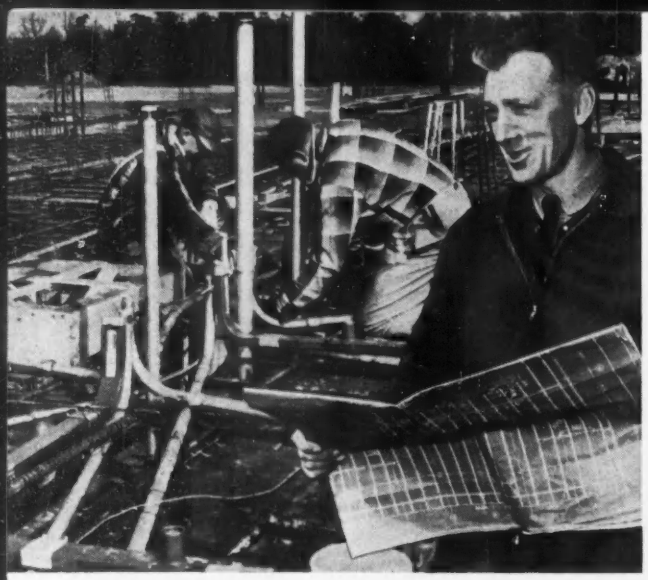
Dependable motor starters: Two years ago, A-C engineers traded the bulk in low-voltage motor controls for the savings of simplicity. With this came exceptional reliability, demonstrated by a substantial drop in the replacement parts business. You can be sure of fewer shutdowns when you specify A-C motor control—still the most advanced, easiest to maintain!

***Vari-Tex* speed changer takes corrosive atmosphere in stride:** At a chemical company, this 25-hp *Vari-Tex* speed changer drives a pump through a single reduction gear unit. It operates in an atmosphere of hygroscopic potash dust which is highly corrosive when wet. *Poxeal* insulation system equips the open *Super-Seal* motor to deliver a long, trouble-free life.



New, lighter, smaller . . . A-C adds 100-kvar size to extended-foil capacitor line. New Allis-Chalmers 100-kvar 95-kv-BIL capacitor weighs just 98 lb, has an all-aluminum case! To complement the new 100-kvar line, the 25- and 50-kvar units have been redesigned with aluminum cases, weights reduced to 37 and 58 lb respectively for 95-kv-BIL units. Mounting centers are still 15⅝ in. and case widths are 4 in. for all sizes from 2400 through 7960 volts.

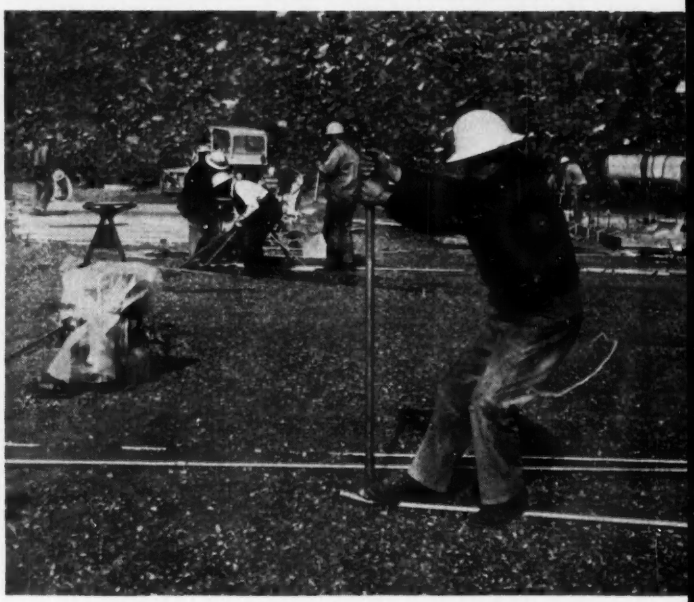
ALLIS-CHALMERS



IN A NEW JERSEY OFFICE BUILDING . . .

AT A POWER COMPANY IN GEORGIA . . .

FOR A DELAWARE APARTMENT HOUSE . . .



ON A DAM PROJECT IN OREGON . . .

SPANG® Conduit uniformity speeds installation

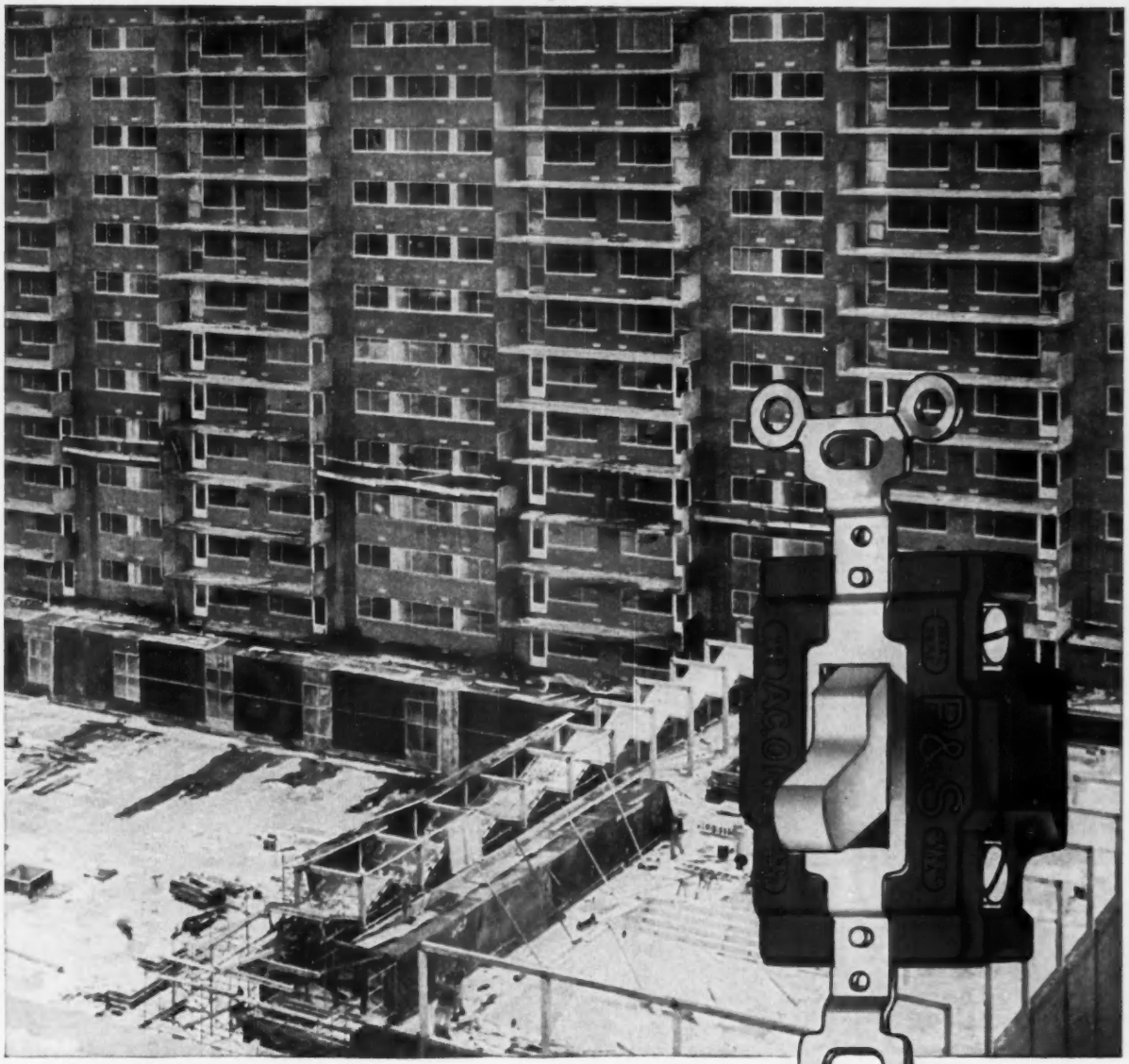
That's the report from the electrical contractor on each of these jobs.

Uniform diameter of Armco's SPANG Conduit provides easy threading on the job site. Uniform wall thickness means no hard or soft spots; result: easy bending.

Uniform threads speed coupling of conduit lengths. Uniform finish means a smooth, even coating inside the conduit for easy wire pulling—and outside for a fine appearance in exposed locations.

SPANG Conduit uniformity can help you speed installations, too. On your next job, try SPANG Conduit, made by Armco. Your nearby SPANG Distributor is at your service with a complete line of SPANG Conduit products. *Armco Division, Armco Steel Corporation, Middletown, Ohio.*

ARMCO Armco Division



ON THE WAY *IN
P&S SUPER AC SWITCHES FROM COAST TO COAST

Write Dept. ECM-462

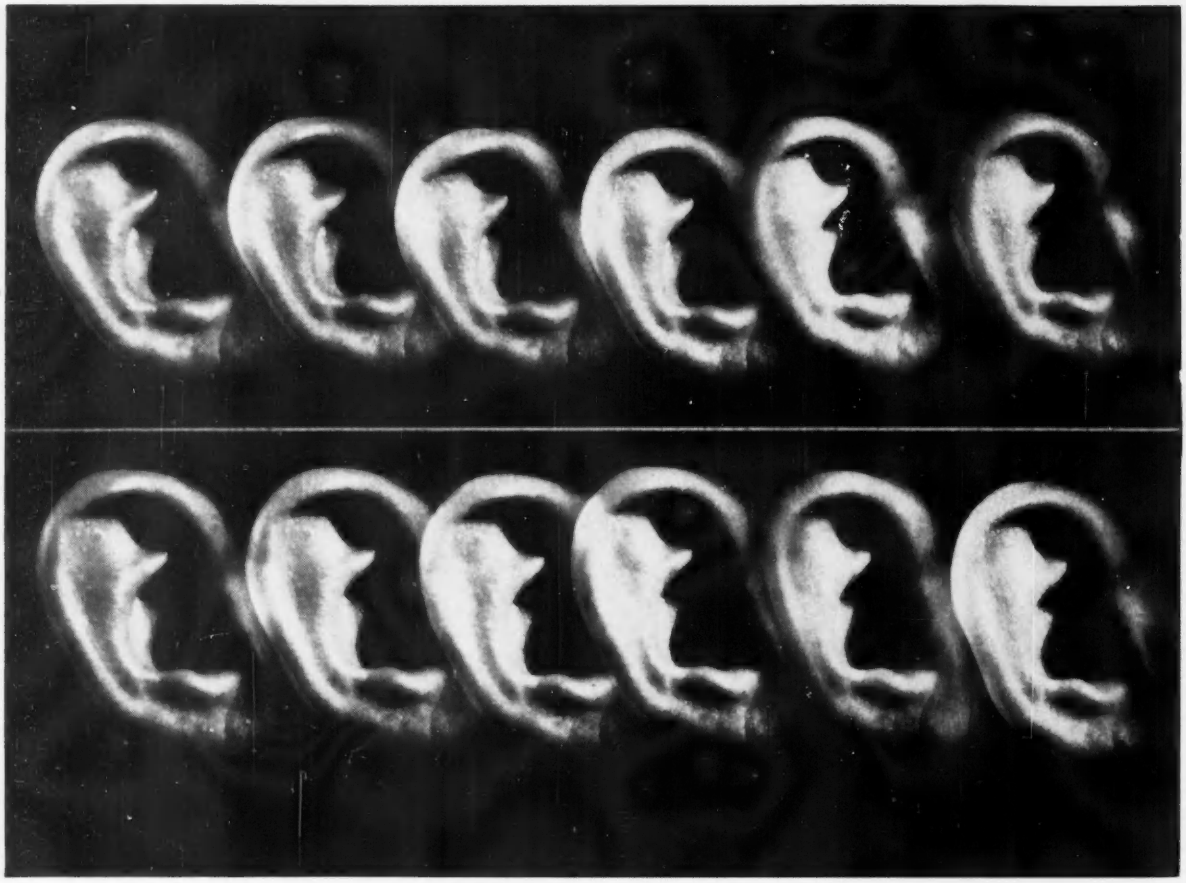
PASS & SEYMOUR INC.

SYRACUSE 9, N. Y.

P&S

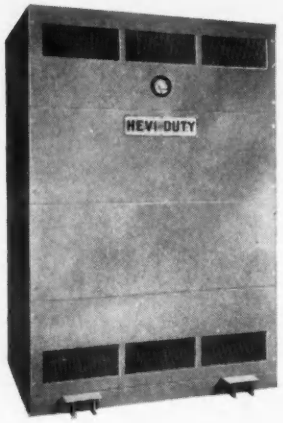
* SPECIFY P&S 20 AC1 LINE

BOSTON CHICAGO LOS ANGELES SAN FRANCISCO



The best ears agree

Hevi-Duty Dry-Type Transformers... so quiet you'll get no complaints



Schools, hospitals, motels, hotels... wherever quiet is the first order of business . . . you'll find Hevi-Duty dry-type transformers your smartest choice for installation.

Cores and coils are especially designed to give low decibel ratings. Moisture and corrosion-resistant polymerizing varnish is baked on in two separate operations. Besides giving excellent electrical protection, this results in substantially reduced noise levels. All laminations and components are bonded together tightly to cut vibrations.

Be sure you obtain these features. Specify Hevi-Duty transformers . . . or write the following into your specifications: Coil and cores "double-impregnated with polymerizing varnish."

For more information, write for Bulletins 100 and 200 or call your nearest Hevi-Duty sales office.

Designed sound levels for typical Hevi-Duty dry-type transformers

SINGLE-PHASE		THREE-PHASE	
KVA	DECIBEL RATING	KVA	DECIBEL RATING
1.0	33	6.0	38
7.5	33	9.0	40
10.0	40	15.0	44
20.0	44	30.0	43
37.5	44	45.0	45
75.0	45	112.5	45
100.0	45	150.0	45
167.0	45	225.0	50
250.0	50	300.0	50
500.0	52	500.0	53

Transformers up to 1000 KVA can be supplied with sound levels of 45 decibels.

HEVI-DUTY

Dry-Type Transformers
Constant Current Regulators

HEVI-DUTY ELECTRIC COMPANY
MILWAUKEE, WISCONSIN
A Division of Basic Products Corporation

H-31-61

Only BURNDY offers all three!

THERMOWELD® — COMPRESSION — BOLTED

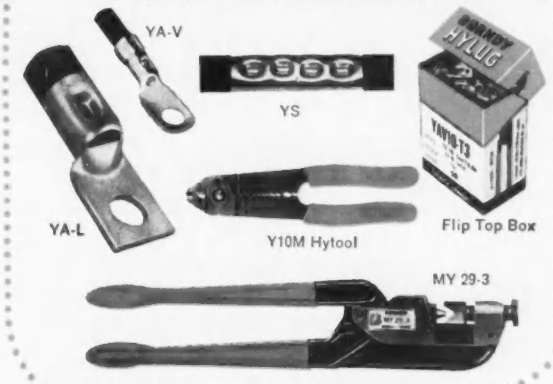
Weld anywhere with lightweight THERMOWELD. Self-contained, needs no external source of power.

Pour powder into mold, tap. Starting powder won't mix with welding powder, assures positive firing.

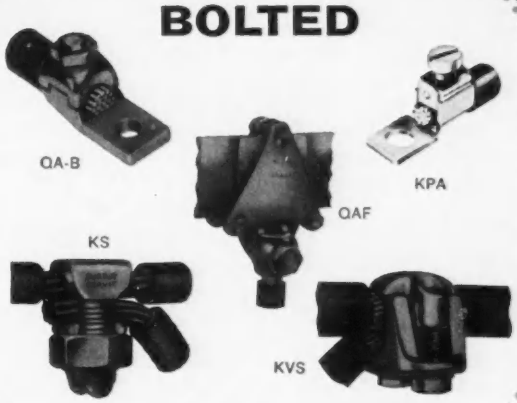
Close cover, ignite with flint gun. THERMOWELD forms liquid copper which fuses conductors into solid mass.

Welds a permanent electrical connection easily and economically to any copper conductor or steel structure.

COMPRESSION



BOLTED



AVAILABLE AT YOUR BURNDY DISTRIBUTOR

BURNDY

61-19

NORWALK, CONNECT. BICC-BURNDY Ltd. Prescot, Lancs., England In Europe: Malines, Belgium TORONTO, CANADA

SPECIFY LIGHTING WITH CONFIDENCE

General Electric *Bonus Line*® Ballasts won't leak or smoke at end of life

General Electric Bonus Line Ballasts are designed to protect against smoking, leaking, or any of the unpleasant conditions which sometimes occur when a ballast fails.

An integrated thermal protection system de-energizes the ballast permanently when extreme temperatures—sometimes characteristic of ballast end of life—are detected. Voltage or current surges will not affect the system. The ballast is de-energized only when failure is *already in progress.*

The protective system consists of two non-resetting thermal protectors, one located near the coils, the other inside the capacitor. No need for external, individual ballast fusing.

Specify General Electric's Bonus Line Ballasts. They give many years of reliable service before end of life. Then they bow out gracefully.

For a technical paper on ballast thermal protection, contact your General Electric Ballast Sales Engineer. Or write to Section 403-04, General Electric Company, Danville, Illinois.

* Trademark, General Electric Company.

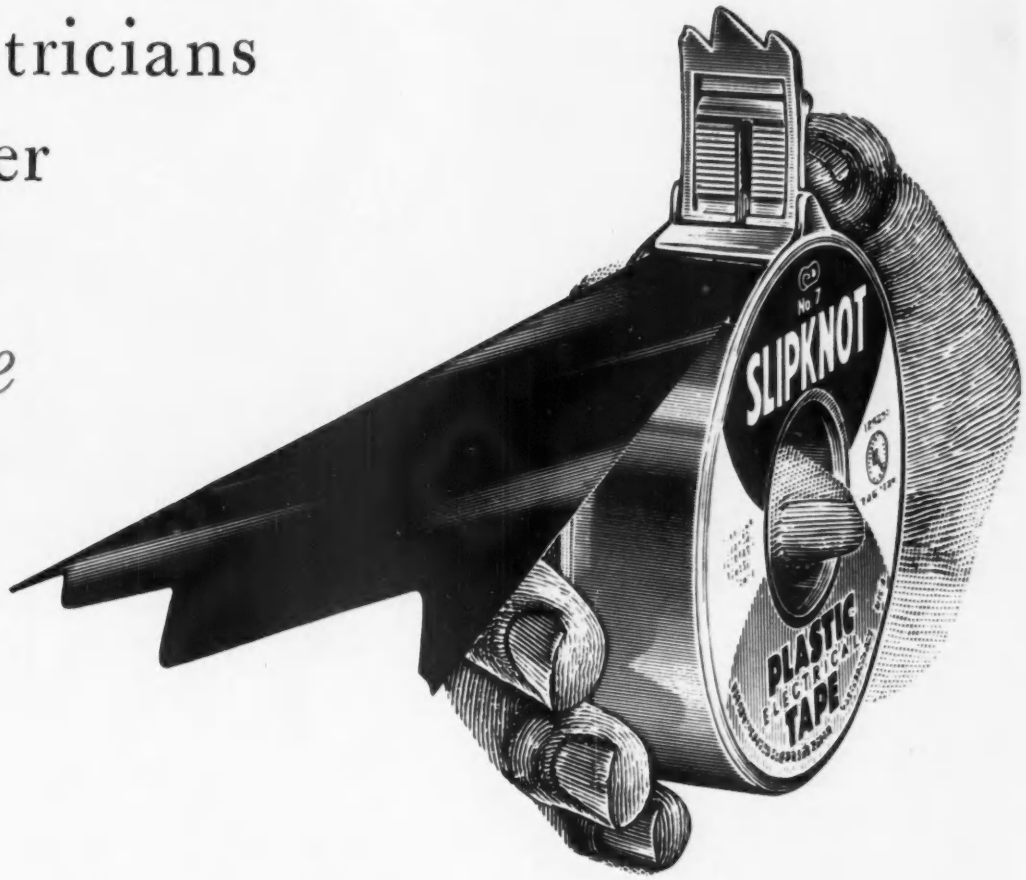
NEW...Another Added Value From *Bonus Line*® Ballasts!

Certain fluorescent fixtures equipped with General Electric Bonus Line Ballasts have recently been listed by Underwriters' Laboratory, Inc., as complying with National Electrical Code requirements for direct surface-mounting on combustible, low-density, cellulose fiberboard ceilings. Contact your G-E Ballast Sales Engineer for details.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Experienced Electricians Prefer *this tape*



SLIPKNOT

Whether you're splicing transmission lines or residential outlets, every splice you make must be *final, safe* and *permanent*. You can only be sure with the *best* — and it costs no more. #7 SLIPKNOT PLASTIC ELECTRICAL TAPE is the choice of electricians who *know*, because it *handles easily, conforms readily*, and *snugs* and *stays down*.

With adhesive *permanently* fused to vinyl base, with *controlled tension* for proper stretch without dangerous thinning — with *unvarying quality* in roll after perfect roll — no wonder #7 SLIPKNOT PLASTIC ELECTRICAL TAPE is the *specified* plastic tape.

Discover why SLIPKNOT is found in all the best splices. On us. Just tell us your distributor's name, on your letterhead, and we'll send you a sample roll.

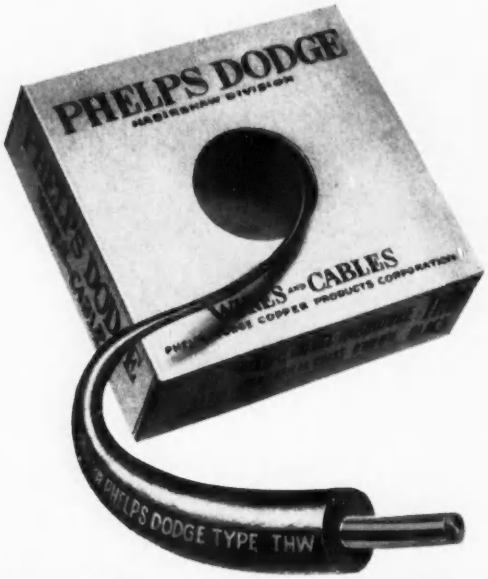
SOLD ONLY THRU RECOGNIZED DISTRIBUTORS

FLIP 'N CUT®, a Slipknot exclusive, speeds the job and saves you money. It's FREE with each 30' - 44' - 66' roll!

FL-7

PLYMOUTH RUBBER COMPANY, INC.

QUALITY SINCE 1896 CANTON, MASSACHUSETTS



Contractors prefer the advantages of

PHELPS DODGE THW WIRE

A 75C thermoplastic-insulated wire rated at 600 volts for wet or dry locations.

The higher rating of Type THW wire offers important cost advantages as compared to Type TW. THW provides increased current carrying capacity in size 8 AWG and larger to accommodate higher power demands. When rewiring an overloaded TW system, THW wire may be installed in the same size conduit, permitting an easy, fast means of increasing capacity at minimum cost.

Type THW features include small diameter, smooth slippery finish, choice of colors and ease of stripping, factors that substantially reduce installation time. The all-around high quality of Phelps Dodge THW assures longer, safer, more efficient system performance.

Available in UL-approved sizes 14 AWG through 500 MCM.

See Your Phelps Dodge Distributor!

PHELPS DODGE COPPER PRODUCTS

CORPORATION • 300 PARK AVENUE, NEW YORK 22, N. Y.

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SALES OFFICES: Atlanta, Birmingham, Ala., Cambridge, Mass., Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Dayton, Denver, Des Moines, Detroit, Fort Wayne, Honolulu, Houston, Indianapolis, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., Salt Lake City, San Francisco, St. Louis, Seattle, Tampa, Washington, D. C.

61ST YEAR • APRIL 1962

ELECTRICAL CONSTRUCTION AND MAINTENANCE

Electrical Contractors Are Selling

At the National Wiring Sales Conference in Atlanta several weeks ago, a photographer lined up about 40 electrical contractors from among the audience for a group picture. They came from all parts of the U.S. Most were "small" electrical contractors whose business operations include a substantial volume in residential wiring. To a man they typified an emerging class of merchandising electrical contractors destined to play an increasingly crucial role in electrical industry marketing.

Traditionally, the residential electrical field has been served by electrical contractors rooted in trade craftsmanship, with little concern for modern merchandising and sales tactics. Limited manpower resources have caused these firms, logically, to orient toward maximizing profitable productive labor hours and to frown on the time and expense involved in what seems to them relatively speculative sales efforts.

This viewpoint, for which the electrical contractor has been widely criticized, is by no means unreasonable. The demand for residential electrical work is high. Qualified craftsmen are scarce. A sound, conservative electrical contractor in a prosperous area has little difficulty putting by a modest profit on steady business that comes in "over the transom" from friends and neighbors of satisfied customers. But, unfortunately, such reactionary marketing no longer serves the needs of the customer nor the progress of the electrical industry.

Today the customer should expect competent craftsmanship but he also has the right to expect competent salesmanship. He is exposed daily to strong and persuasive electrical industry advertising. The benefits extolled are largely beyond his reach until they can be interpreted in terms of actual products and services by the local electrical contractor. Thus selling has become a vital part of the essential services the contractor performs for his customer.

Merchandising tactics are bringing many able residential electrical contractors out of unwarranted obscurity. Their headquarters are attractive and well located. Their trucks are efficient current models; well-kept, rolling identification of the firm and of its cooperation with current national and local industry promotional activities. Their electricians are neatly uniformed. They make skillful use of advertising and sales promotion materials. But perhaps most important of all they are willing to devote time and expert knowledge to advising and guiding their prospective customers; in other words, selling.

Does it pay? Few appear to be much concerned about competition or price. Most find it routine to build a sales package substantially larger than the particular installation that triggered the customer's inquiry. An interesting and significant result of their sales efforts is a sharp increase in the ratio of sales to payroll, a breakthrough that has long been needed in residential electrical work.

Wm. T. Stuart

ARC CONTROL...SIMPLE AS SNUFFING A CANDLE. IN BULLDOG SAFETY SWITCHES, AN EXCLUSIVE VACU-BREAK® ARC CHAMBER EXTINGUISHES ELECTRICAL ARCS JUST AS EFFECTIVELY. BUY WITH CONFIDENCE...BUY BULLDOG. CONTACT YOUR I-T-E DISTRIBUTOR OR LOCAL I-T-E SALES OFFICE TODAY!

Write for your copy of "The Story Behind the Ad".

I-T-E CIRCUIT BREAKER COMPANY
BULLDOG ELECTRIC PRODUCTS DIVISION
BOX 177 • DETROIT 32, MICHIGAN

In Canada: 80 Clayson Rd., Toronto, Weston, Ont.

Chicago Apparatus Service Shop Features

A sampling of what motor repair specialists will see when they visit Chicago shops during the 1962 EASA Convention in June.

ELECTRICAL apparatus repair specialists throughout the country will be going to Chicago June 10-13 to attend the 29th Annual Convention of the Electrical Apparatus Service Association (formerly NISA) at the Conrad Hilton Hotel. As in the past, this will be another working conference offering seminars, forum sessions and discussion groups. Individual shop problems as well as broad industry problems will be analyzed. High on the priority list will be the usual exchange of ideas reflecting new and improved shop technology, management operation, customer service, business ethics and profitable operation. Between sessions, delegates will be able to visit a suppliers' show in the hotel exhibit hall.

Convention host this year is the Central District Chapter, EASA, which includes some 42 Chicago shops. Many of these have developed techniques geared to their specific markets; others have diversified their operations; all are striving to do a better job for themselves and their customers.

Shop owners like to compare their own operation with that of others. EASA delegates will be able to do just that while in Chicago. The convention committee has arranged tours of representative local shops and hopes both visitor and visited will benefit by these get-togethers on home grounds. All Chicago shops will welcome EASA delegates during convention week.

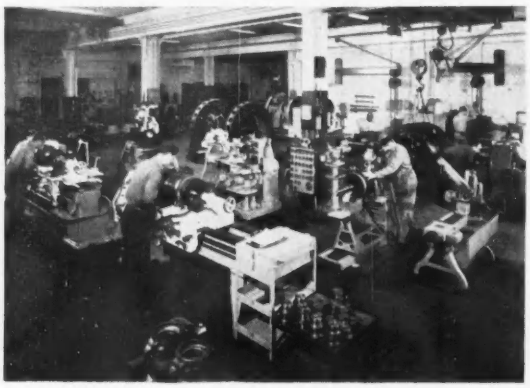
The accompanying "look inside Chicago shops" is a necessarily small sample of the shop facilities to be seen. Awaiting the shop visitor are a variety of improved techniques running the whole gamut of motor repair operation and shop diversification. Here he may find the key to the solution of one of his problems—or he may be able to help solve a host's problem too.

Sievert Electric Co., Inc.

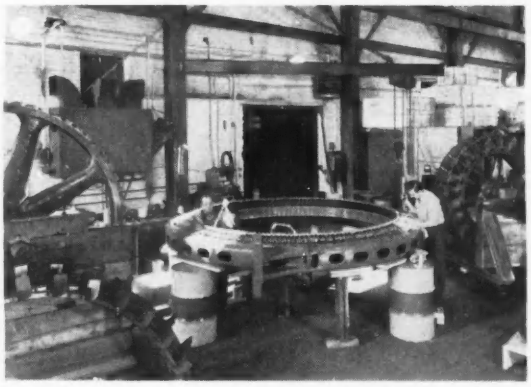
CONTINUITY PHASE method of winding coils with special winding head. Up to 16 coils per phase, 4 coils per group, can be wound in a continuous operation. Method eliminates cross connections of coils when placed in stator; saves time.

COIL FORMING variety is commonplace in a motor repair shop. Typical are the multi-curved coils for an electric truck armature (in foreground) and long hairpin 50-hp crane armature coils with ¼-in. nose for which special tooling was required.

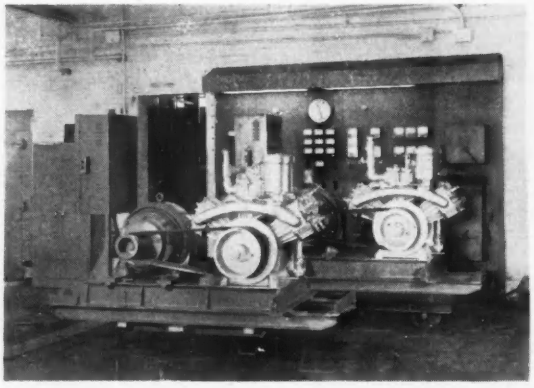
Chicago Electric Co.



MACHINE SHOP equipment is basic to complete electric apparatus repair and rebuilding service. Size and type of facilities vary with range of work shop does. This shop is geared to large work.

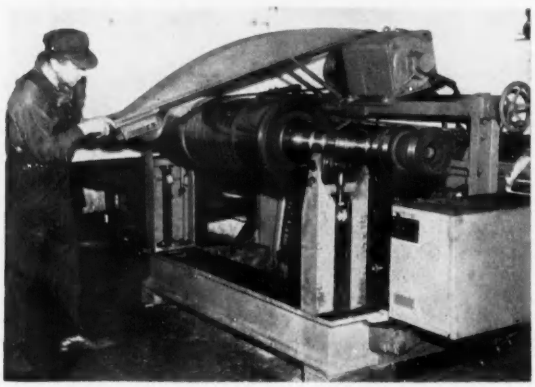


3,000-HP high-voltage stator gets new set of coils in high-bay shop area equipped with traveling crane and column swivel hoists to facilitate equipment handling.

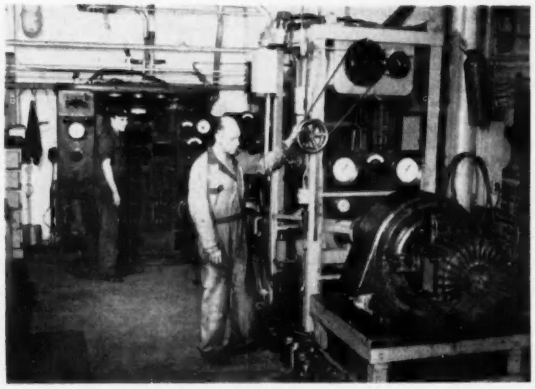


READY FOR TEST are two compressor packages shop assembled complete with 60-hp motors, starters and special base. Dead-front board at rear has 200 kw, 110-volt to 2300-volt range; has underground circuits to test area in large equipment building; has PA system to coordinate testing in remote area.

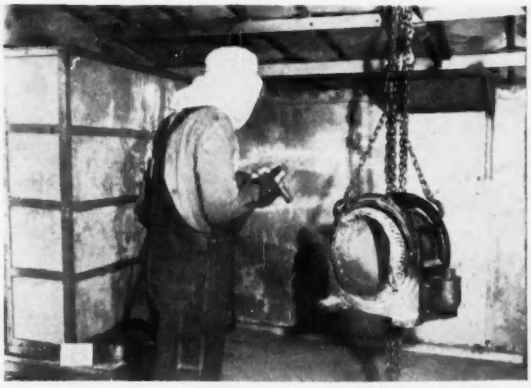
Arthur Wagner Co.



SHOP-BUILT dynamic balancing machine can balance equipment up to 4,000 lb, 60-in. maximum diameter, and 8 ft in length. It is used for armatures, flywheels, pulleys, shafts and other rotating equipment.

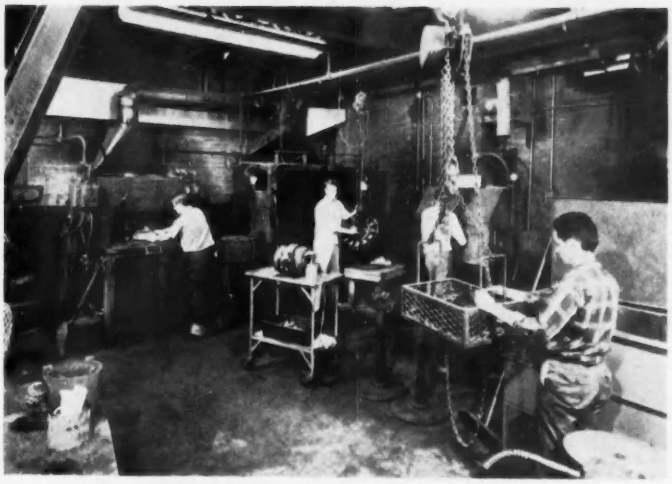


DYNAMOMETER TESTING is a routine procedure to check motor and generator operation under load conditions. Test Assembly of this 100-kw shop-built unit elevates for shaft alignment. Here, a 100-hp slip-ring motor is being tested for speed regulation.

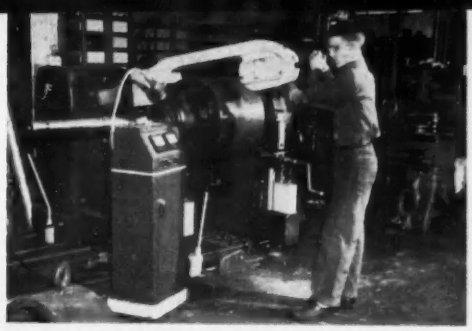


CORN GRITS cleaning removes dirt and grime from stator windings without damaging coil insulation. Blast of ground corn cobs under high air pressure comes from nozzle directed at winding.

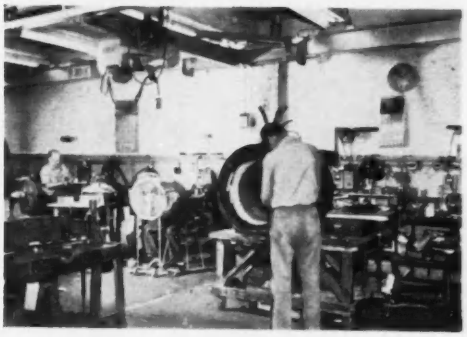
Hyre Electric Co.



WELL EQUIPPED parts cleaning department provides automatic solvent spray, air and steam cleaning booth, sand-blast cabinet and detergent degreasing tank at one end of shop. Plenty of hoists simplify parts handling.



DYNAMIC BALANCING unit using electronic principles is the latest equipment addition to this air conditioned shop. Unit's capacity ranges from 2 to 8,000 lb and up to 60-in. dia. rotors. Rotor being balanced is for a 150-hp motor.

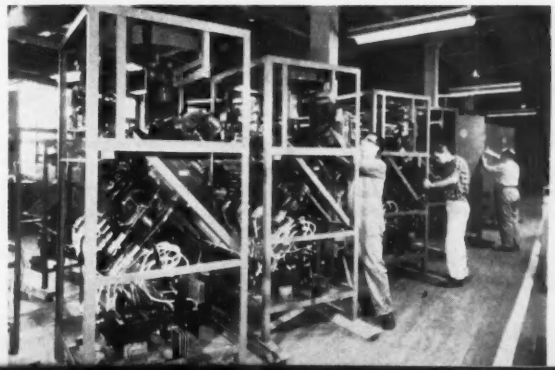


MORE THAN 100 footcandles of general lighting is maintained in this air conditioned motor repair department. Parallel overhead cranes run length of shop.

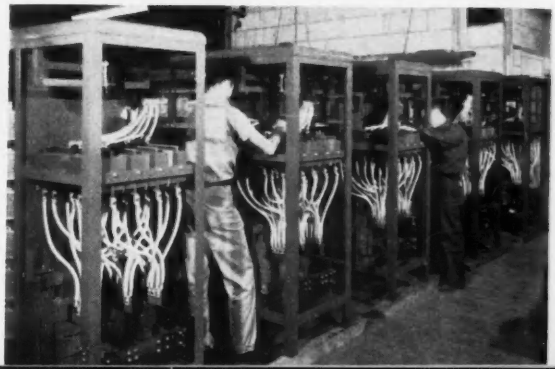
Ther Electric & Machine Works, Inc.

COIL DEPARTMENT has a number of winding heads with different forms to meet shop repair requirements. Wound coils are taped on tables in background.

ASSEMBLY OF special fan-cooled, magnetic-amplifier controlled silicon rectifiers. These 3,000-amp, 12-volt units are used in the plating industry.



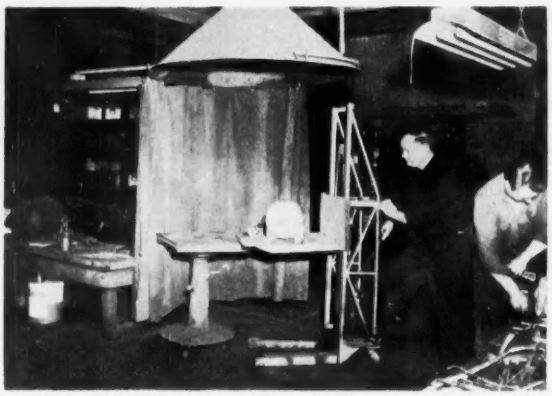
PLATING RECTIFIERS in final assembly line. Mechanics are making connections on 2,000-amp, 9-volt selenium units used in the plating industry.



Excel Electric Service Co.

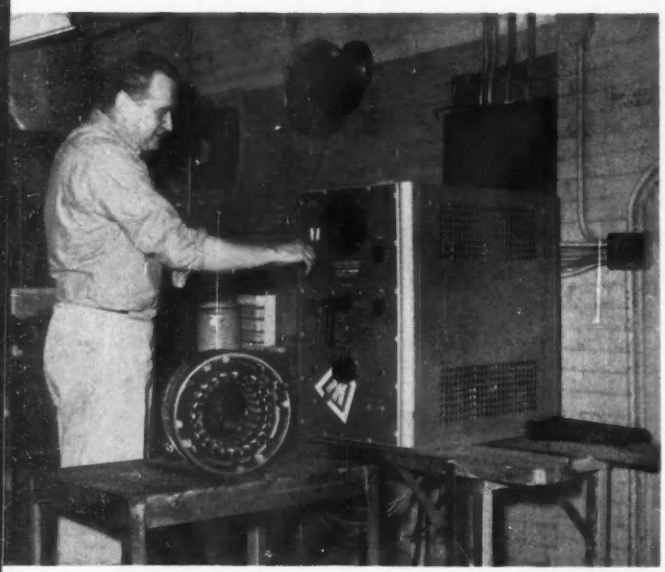
SUNKEN DIP tank next to bake oven holds 275 gal of pure epoxy-resin varnish used on standard rewinds in this shop. Mechanic can quickly check complete submersion of winding and easily transfer unit to oven dolly for bake cycle.

TOTE BOXES hold all parts of disassembled motors. Twin rack stores 120 metal boxes. Last digit of customer order number is keyed to shelf number for quick identification. Flanged rims on 12-in. by 18-in. by 7-in. boxes permit convenient stacking when empty.

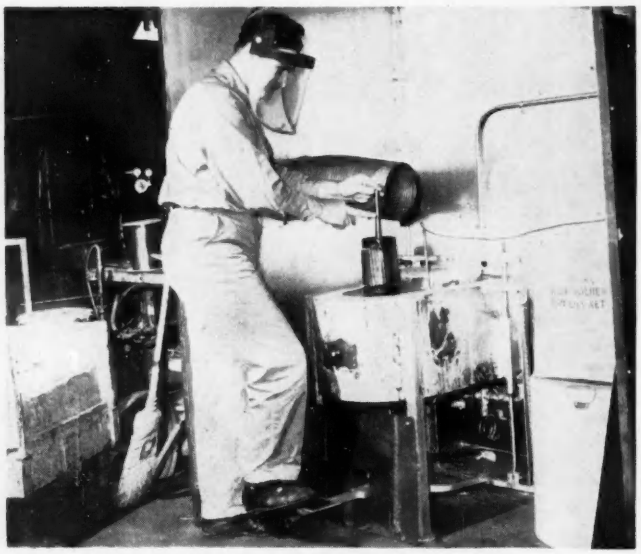


MOBILE PLATFORM lift elevates equipment from floor to bench, truck or shelf level. Motor above is being raised to turntable pedestal in front of paint spray curtain. Exhaust hood pulls out excess spray and fumes.

Northwestern Electric Co.



SURGE TEST of insulation on 3-phase windings. Unit has range of 300 to 2,000 volts; compares one phase against another. Defects show up on oscilloscope as departures from normal waveform.



GIANT SOLDER POT speeds soldering commutator end of dc rotors. Mechanic sets rotor on positioning sleeve. Pressure on foot pedal raises level of solder pool to top of commutator. Release of pedal lowers solder level.

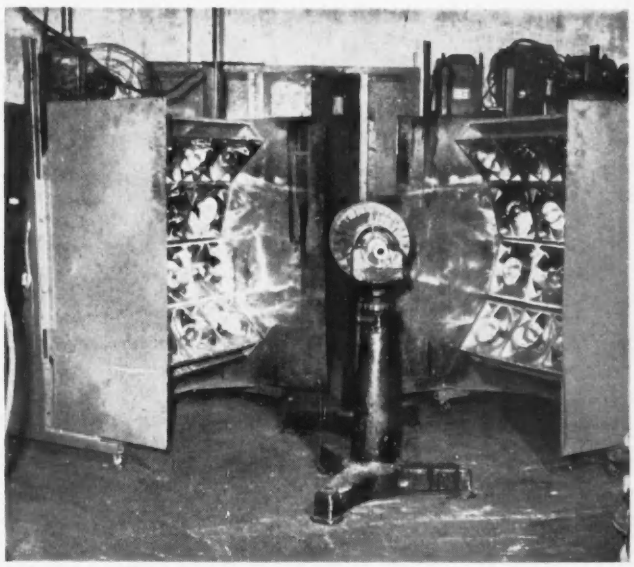
Hygrade Electric Co.

FORK LIFT trucks substantially cut shop material and equipment handling time and costs. Here, mechanic on fork pallet removes rebuilt motor from storage rack with comparative ease.

DOUBLE WALK-IN bake oven provides ample room for large and small (usually on slotted-angle mobile rack) repair items. The 12-ft by 12-ft by 9-ft unit is heated by an infrared gas combustion system. A smaller bake oven is also used for light loads or as a supplementary facility.

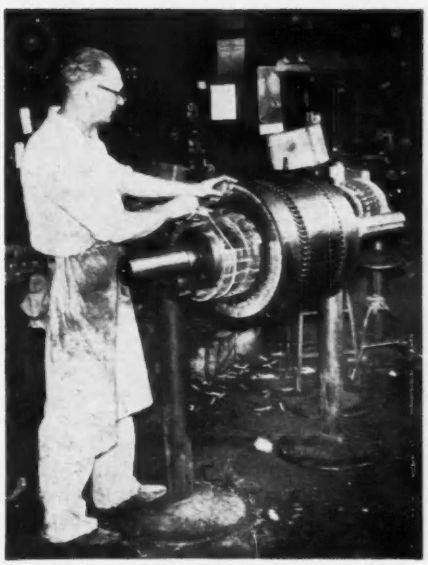
DEAD-FRONT main test board provides 110- through 440-volt, 3- and 2-phase and 20-through 300-volt dc test voltages. Transformers are stacked at left of board. Stator under test is for a 135-hp, 3-phase, 440-volt motor.

Roberts-Stage Electric Co.



MOBILE BANKS of infrared heat lamps bake rotors and stators in shop or field. Each bank has 16 375-watt heat lamps in four rows in concave pattern. Lamp and end-shield assembly has 21-in. vertical adjustment on continuous-channel frame.

Hohman & Hill, Inc.



REPLACING COMMUTATOR segments is a patient hand job. This 75-hp 230-volt dc armature has 224 segments, each individually cleaned and reset with mica separators.

ARTIFICIAL ILLUMINATION is maintained constantly at 120 footcandles on lower floors, regardless of exterior lighting intensity. Upper floors obtain double this lighting level through north-facing sawtooth skylights during normal daylight hours, although photocell controls and sunswitches operating from special 277-575/240-volt single-phase transformers automatically activate additional fluorescent circuits for cloudy-day or night-time augmentation.

Distribution designed for

Plant Expansion

A western electronics firm with 10-year 15-fold expansion rate occupies modern plant where electrical facilities in modern $4½-million 4-building complex are designed for double present capacities. Installation features photocell control of lighting; air conditioning with electrostatic filtering; multiple load centers and distribution system combining use of busway and underfloor ducts; armored cables and basket trays.

AN ATTRACTIVE, modern multi-function electronics plant has just been dedicated in Palo Alto, Calif., marking the 20th anniversary of Hewlett-Packard, manufacturers of electronic measuring instruments.

Located on a 50-acre hillsite adjacent to Stanford University, the center represents an investment of $4½-million, not counting cost of equipment or ground, and the 4-building complex contains nearly 10 acres of floor space devoted to administrative, research, development, warehousing and manufacturing purposes. Each manufacturing department is highly autonomous with its own sheet-metal, painting, assembly and testing facilities; and these separate departments are additionally served by centrally-located divisions handling machine work, plating, receiving and shipping.

Throughout this center electrical distribution is flexible; power is provided at a variety of voltage levels with ample spare capacity for growth; lighting is controlled automatically by exterior photocell monitors and activating devices; air is electrostatically cleaned as well as thoroughly tempered prior to circulation, and layouts of departments and equipment are highly functional.

Electrical distribution reflects a realistic appraisal of the company's growth pattern; a pattern recording a 5-fold increase in production and sales during half a decade, with the curve still heading sharply upwards. Therefore today's plant, already twice as large as it was four years ago, is designed for another doubling of facilities in the near future without overloading already-installed transformers and feeders.

This planned expansion program began with construction of Buildings 1 and 2. Then, while Buildings 3 and 4 were being added to the complex, temporary power for lighting and construction tools was obtained from Load Center 1, and 4160-volt primary connections were extended from Substation 2 to two new load centers in Building 4.

From these new primary stations (4 and 5), underground ducts and conduits were extended further to carry future primary power to con-

MAIN ENTRANCE and lobby are attractively highlighted by various treatments featuring luminous ceiling areas, recessed concave plexiglas discs, coves and downlights. Full-height glass panels maintain visual continuity between interior and exterior structural details.

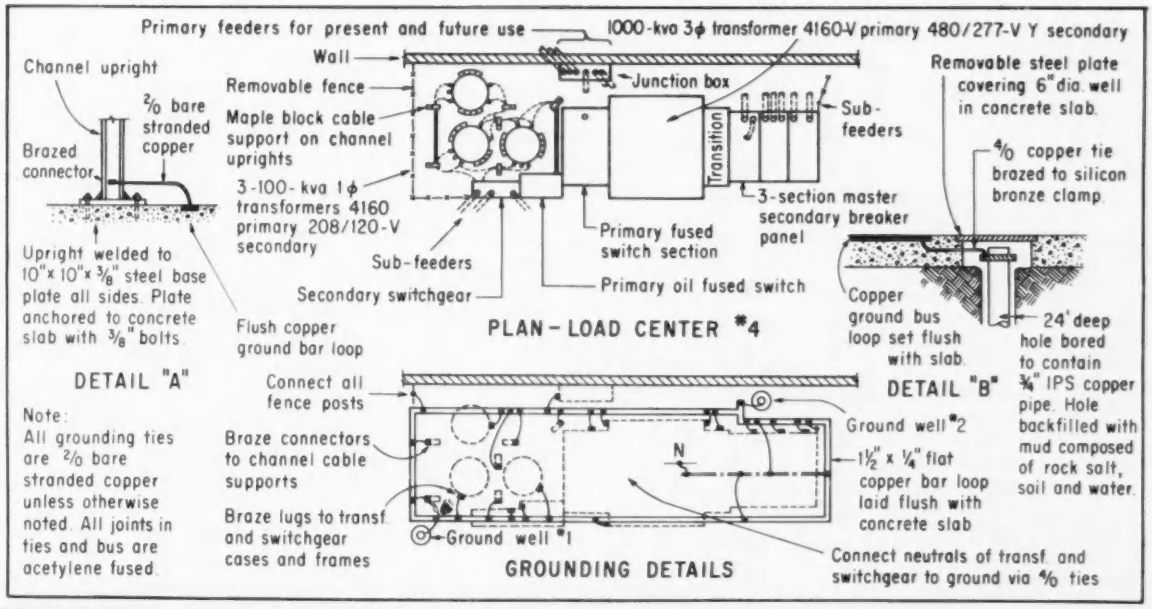
templated Load Centers 6 and 7, as well as to carry present secondary service to sub-distribution centers in Buildings 4 and 3. Building 3 is additionally served from existing master switch panels in Building 1.

In establishing this basic distribution layout, all now-empty conduits, related to future service in buildings yet-to-be-completed, were extended through existing walls, capped, sealed against moisture, boxed below ground level and identified for future reference.

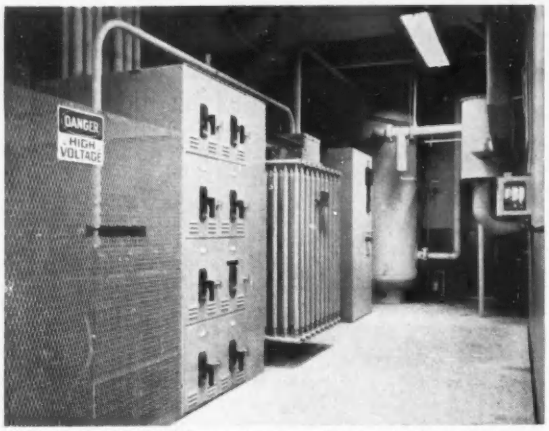
In cases where these underground ducts contain primary feeders, wiring consists of 5-kv butyl-insulated single conductors having semiconductive shielding and neoprene jackets. Underground wiring related to secondary 480- and 208-volt circuitry consists of Type RHW conductors; No. 2s being installed where overload protection in the order of 400-600 amps is required; No. 4s for 200-400-amp protection, and No. 6s for circuits rated from 200 down to 40 amps. In addition, secondary feeders are grouped with bare stranded copper ground wires.

In establishing primary connections between Load Centers 2 and 4, it should be mentioned that feeders were first carried approximately 300 ft through the basement of Building 2. This primary segment consists of 5-kv 3-conductor jute-filled tape-bound interlocked armor cables supported by basket trays positioned 18 in. beneath ceiling slabs. Trays are variously suspended by rod hangers anchored to slab-incorporated lipped building channels, also by wall brackets secured in turn by bolts and calking anchors. Trays are a foot wide, equipped with outward-flanged 3-in. side channels, cross-struts on 1-in. centers and coordinated elbows. Conduit drop-outs are provided at the end located above Load Center 2, thereby permitting feeder conductors to connect directly with lugs of a 1200-amp 5-kv main switch in that metal-clad assembly. At the opposite end of the 300-ft-long tray, armored cables terminate at a liberally sized (30- by 70- by 20-in.) junction box which is wall-mounted, internally braced and equipped with top-front box flange for connection to the tray; bottom conduit drops for connection to the underground section of this primary run, and a 30- and 60-in. removable cover to facilitate cable pulling, splicing and inspection.

All load centers are similar in that each has an incoming primary


Primary feeders for present and future use
1000-kva 3φ transformer 4160-V primary 480/277-V Y secondary
Wall
Junction box
Removable fence
Maple block cable support on channel uprights
3-100-kva 1φ transformers 4160 primary 208/120-V secondary
Transition
Sub-feeders
3-section master secondary breaker panel
Primary fused switch section
Primary oil fused switch
Sub-feeders
Secondary switchgear
Flush copper ground bar loop
PLAN - LOAD CENTER #4
Channel upright
2/0 bare stranded copper
Brazed connector
Upright welded to 10" x 10" x 3/8" steel base plate all sides. Plate anchored to concrete slab with 3/8" bolts.
DETAIL "A"
Note:
All grounding ties are 2/0 bare stranded copper unless otherwise noted. All joints in ties and bus are acetylene fused.
Removable steel plate covering 6" dia. well in concrete slab.
4/0 copper tie brazed to silicon bronze clamp.
Copper ground bus loop set flush with slab.
24' deep hole bored to contain 3/4" IPS copper pipe. Hole backfilled with mud composed of rock salt, soil and water.
DETAIL "B"
Connect all fence posts
Braze connectors to channel cable supports
Braze lugs to transf. and switchgear cases and frames
Ground well #1
Ground well #2
N
1 1/2" x 1/4" flat copper bar loop laid flush with concrete slab
Connect neutrals of transf. and switchgear to ground via 4/0 ties
GROUNDING DETAILS

LOAD CENTERS provide 480/277- and 208/120-volt service for office, manufacturing and testing. Transformers, switchgear enclosures and related structural members are positively grounded by brazed connections, and a slab-recessed copper bar loop and IPS pipes are contained in salt-packed holes.



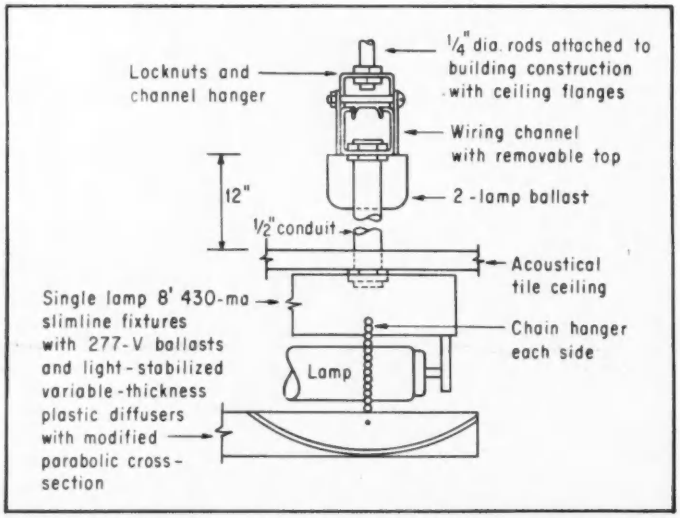
PRIMARY VOLTAGE obtained at key switching station is 4160; power then being stepped to 480/277 wye for distribution to load centers, motor control switchgear, air conditioning compressors and fluorescent lighting panels; and again reduced to 208/120 for electro-plating, incandescent lighting, kitchen equipment and incidental power receptacles.

PLUG-IN BUSWAY (arrow) is used to distribute 480/277- and 208/120-volt power throughout manufacturing sections of the plant. Busbars are silver-plated aluminum; neutrals are half- or full-phase size depending upon local loading characteristics. Enclosures and plug-in breaker cubicles are stencilled plainly with voltage and ampere ratings.

feeder, fused main switch and 1000-kva 3-phase unit substation stepping 4160-volt service to 480/277 volts wye for distribution via a 3-section master switch panel to remote local switching centers—related to lighting, production equipment, air conditioning compressors, elevators, fans and motors.

In addition, however, centrally located load center 4 has a second 500-kva 3-phase transformer bank supplying 208/120-volt service for electroplating, kitchen equipment, incandescent lighting and incidental utility panels. In this second transformer assembly the primary switch is oil fused, while airborne cables connecting transformers with primary and secondary switchgear are supported by maple clamps on free-standing channel uprights base-welded to bolt-anchored bearing plates.

Channel uprights as well as all substation transformer tanks, switchgear neutrals, cubicles and fence enclosures are grounded by means of bronze-brazed lugs, No. 2 bare stranded copper ties, station-surrounding flat copper 1½- by ¼-in. bars set flush with concrete base slabs, silicon-bronze ground clamps and 24-ft-long ¾-in. IPS copper pipes sunk in deep bored holes backfilled with rock salt and mud.


Locknuts and channel hanger
¼" dia. rods attached to building construction with ceiling flanges
Wiring channel with removable top
12"
2-lamp ballast
½" conduit
Acoustical tile ceiling
Single lamp 8' 430-ma slimline fixtures with 277-V ballasts and light-stabilized variable-thickness plastic diffusers with modified parabolic cross-section
Chain hanger each side
Lamp

LUMINOUS CEILINGS in executive offices and board room include series of parabolic plastic diffusion panels chain-suspended beneath lamps. Ballasts and wiring channels are located above acoustical plane.

General discussion of distribution should likewise include references to plug-in busway runs serving production departments, and to underfloor double- and triple-cell ducts installed in office areas.

Plug-in busway assemblies are used to distribute either 480/277 or 208/120-volt 3-phase power, neutrals variously half or full-phase sized depending upon local loading characteristics.

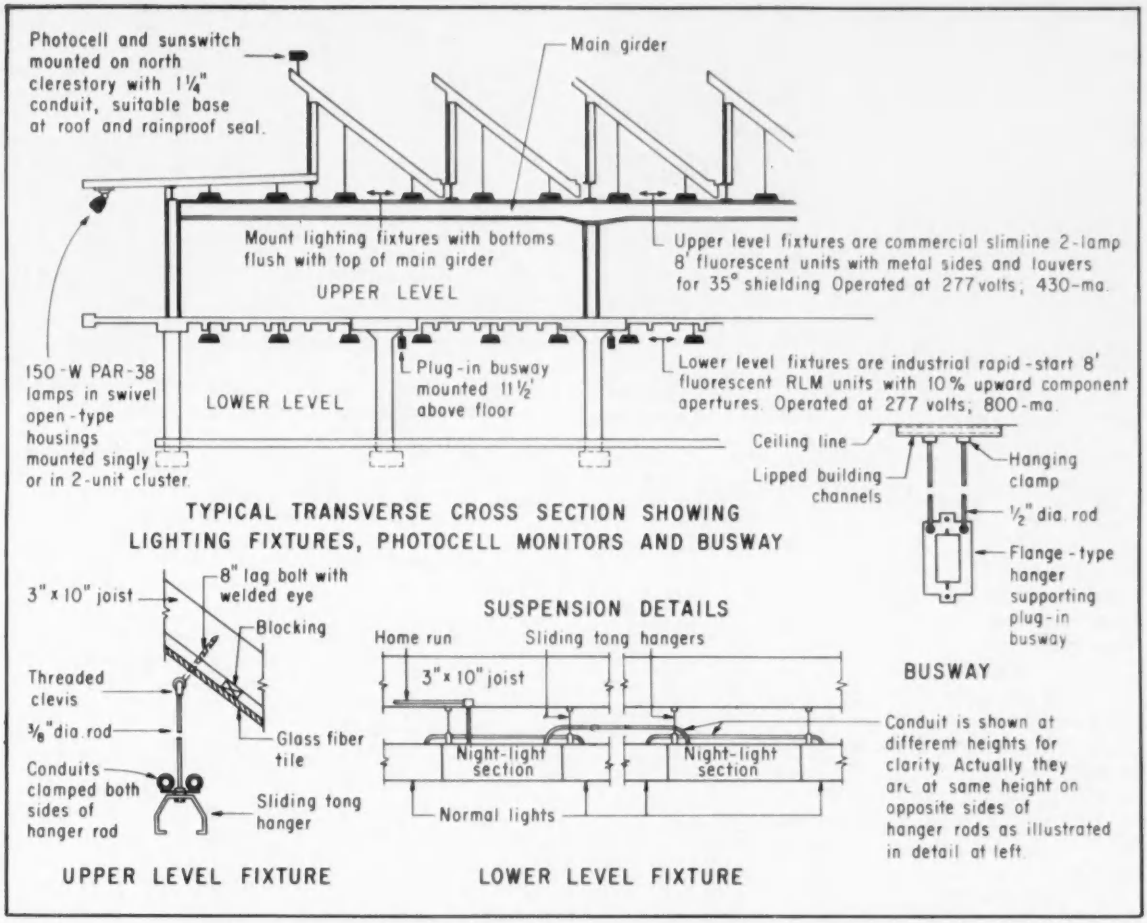
Safety as well as correct establishment of take-off connections is insured by the practice of plainly stencilling voltage and ampere ratings in large white enamelled letters and figures on both sides of all duct runs at 25-ft intervals, while all plug-in disconnect cubicles are similarly labeled with fuse ratings, distribution index numbers and main switch control locations.

In several manufacturing locations where use of electric tools is desirable at many points along long assembly lines or benches, movable power take-off devices are used in connection with trolley busways.

As to underfloor ducts, junction boxes were positioned, levelled to finished-slab elevation and anchored to base slabs prior to final pour, while interconnecting duct sections were similarly pre-installed 1½ in. below finished datum planes.

Local Control Provisions

In this electronics center, plant-wide air conditioning is obtained through numerous local unit electrostatic filter, fan and associ-


Photocell and sunswitch mounted on north clerestory with 1¼" conduit, suitable base at roof and rainproof seal.
Main girder
Mount lighting fixtures with bottoms flush with top of main girder
UPPER LEVEL
Upper level fixtures are commercial slimline 2-lamp 8' fluorescent units with metal sides and louvers for 35° shielding. Operated at 277 volts; 430-ma.
150-W PAR-38 lamps in swivel open-type housings mounted singly or in 2-unit cluster.
LOWER LEVEL
Plug-in busway mounted 11½' above floor
Lower level fixtures are industrial rapid-start 8' fluorescent RLM units with 10% upward component apertures. Operated at 277 volts; 800-ma.
TYPICAL TRANSVERSE CROSS SECTION SHOWING LIGHTING FIXTURES, PHOTOCELL MONITORS AND BUSWAY
Ceiling line
Lipped building channels
Hanging clamp
½" dia. rod
Flange-type hanger supporting plug-in busway
BUSWAY
3" x 10" joist
8" lag bolt with welded eye
Blocking
Threaded clevis
⅜" dia. rod
Glass fiber tile
Conduits clamped both sides of hanger rod
Sliding tong hanger
UPPER LEVEL FIXTURE
SUSPENSION DETAILS
Home run
Sliding tong hangers
3" x 10" joist
Night-light section
Night-light section
Normal lights
LOWER LEVEL FIXTURE
Conduit is shown at different heights for clarity. Actually they are at same height on opposite sides of hanger rods as illustrated in detail at left.

SKYLIGHTS and sawtooth construction of roof influenced methods of suspension and control of lighting systems. Photocell and sunswitch units are mounted atop north-facing clerestory.

ated equipment assemblies. Control panels related to these facilities are sectionalized, with circuit breakers grouped together, and with motor-control sections consisting of individual starter cubicles having reset buttons mounted on faces of separate hinged doors. Designed for 480-volt service, these panels are floor-standing factory-wired units with liberal side and bottom wiring gutters and with starters equipped with 120-volt coils and 3-leg overload protection.

Other 480/277-volt equipment in the plant is controlled from panels variously equipped with single-pole 277-volt, or multi-pole 480-volt breakers; access doors located over electrically operated mechanically held contactors; coils operating in these cases at 277 volts. Moreover, where motorized equipment is remotely located or not visible from such control panels, additional 480-volt horsepower-rated safety switches, fused or non-fused as required, are located in standard enclosures adjacent to the related operating equipment.

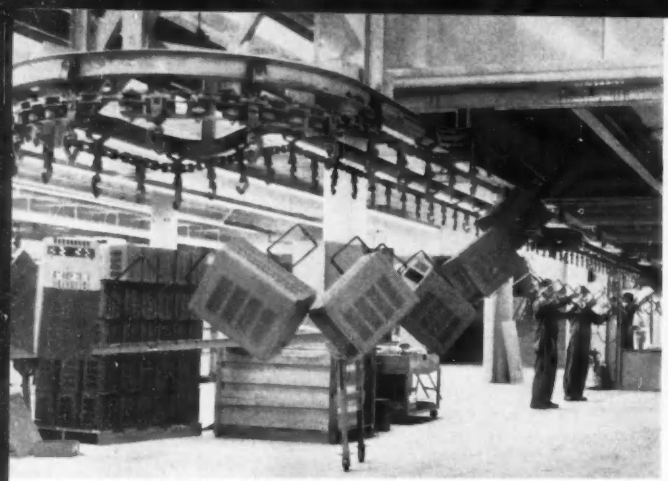
Master switch and utility panels pertaining to 120/208-volt use are in all instances wired for 3-phase, 4-wire service; master breakers being rated for 240 volts with minimum interrupting capacities of 15,000 amps. Plug-in type branch-circuit breakers are attached to panel busses so arranged that any three consecutive single-pole switches located on either side of a panel will constitute a complete 3-phase, 4-wire grouping.

Branch wiring is generally carried in concealed rigid steel conduit or EMT; principal exceptions being where flexible conduit is used for connection of motors and recessed lighting equipment. Other exceptions pertain to specialized locations such as the computer room, where the main floor-slab is depressed 12 in.; a trussed deck slab re-establishes desired floor elevation while maintaining a full-area unobstructed wiring cavity below, and wiring from related distribution panels is conveyed into this cavity by steel elbows that stub out from walls in the depressed cavity area. All branch circuitry is color coded; generally Type TW or, where conduit temperatures are liable to exceed 100° F, Type AVA.

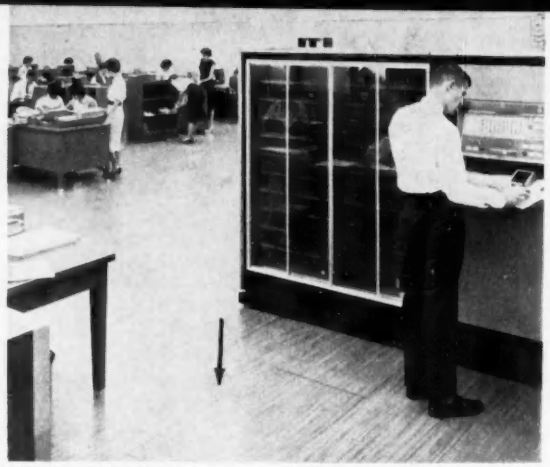
Varied Lighting Plan

Depending upon location, application and desired visual effects, lighting is variously decorative or functional, commercial or industrial in character. For example:

. . . Luminous ceilings are installed in cafeteria, board room, principal private offices and sections of the main lobby. With curved plastic diffusing panels chain-suspended beneath banks of slimline lamps, these several installations are similar in appearance. Basic differences do exist, however, since cafeteria and lobby installations have ballasts, fixture chassis and interconnecting conduit surface-mounted



MOTORIZED CONVEYOR carries instrument chassis up into 120-kw electric oven where regulated temperatures in order of 250-350° F are maintained for enamel drying purposes. Due to wide variety of production facilities, power distribution in factory areas is effected via feeder and plug-in busways.



INFINITE ACCESS (by means of large removable inserts) to space between double floor of tabulating room affords maximum flexibility for placement or reorientation of wiring serving such electronic equipment as the Univac in the right foreground.

directly beneath acoustically tiled building construction slabs, whereas office and board room installations place rod-suspended wiring channels and ballasts above suspended acoustical panelling in order to completely isolate ballast noise. These latter installations also differ in that alternate rows of lamps are staggered between two circuits so that 2-level illumination (125 and 200-fc) may be obtained by selective switching.

. . . To introduce varied elements of pattern, intensity and color in the lobby, designers also included an assortment of recessed concave plastic-diffused 2-ft diameter 6-lamp 20-watt fluorescent fixtures; also opal-glass diffused close-ceiling incandescent units; also recessed downlights and bullet-hooded R-lamps installed around peripheries of circular skylights that pierce a cantilevered canopy overhanging the lobby's all-glass entrance.

. . . In general office areas, even distribution of light is provided by 8-ft 2-lamp commercial slimline fixtures mounted in continuous rows, operating at 430-ma, equipped with metal side panels and eggcrate louvering to obtain 35-degree shielding laterally and longitudinally, and designed with canopy apertures permitting a 10% component of light to reflect upwards to minimize ceiling brightness ratios.

. . . Fluorescent fixtures in continuous rows with a 10% upward lighting component likewise are installed in manufacturing areas, although in such locations fixtures are 2-lamp industrial RLM units with porcelain enameled reflectors and rapid-start 8-ft lamps operating at 800-ma.

In connection with lighting of general office and manufacturing space it is pertinent to mention that, since sawtooth-construction buildings are designed with parallel banks of skylights facing north, interiors of upper floors normally obtain considerable daylight to augment artificial illumination. Therefore operation of upper-floor fluorescent installations is related to outdoor brightness, with photoelectric sunswitches automatically turning lights on and off in accordance with varying daylight intensities.

Sunswitches, operating from special 277-575/240-volt single-phase transformers, control lights in banks via relays, contactors and breakers. And, to preclude frequent, annoying on-and-off cycling of lights on alternately cloudy-bright days, controls also incorporate time-delay clocking devices. Lighting may also be controlled from local panels, either by direct manual switching or from remote locations through appropriate contactors.

Architectural design of this plant was by Clark, Stromquist, Potter and Ehrlich of Palo Alto. General contractors were Wells P. Goodenough of Palo Alto and Williams & Burrows of Belmont. Consulting engineers were Ackerman & Aronoff, Palo Alto, while electrical contracting was handled by Scott-Butner, Oakland.

CAFETERIA obtains high-level even illumination from luminous ceiling featuring double diffusion principle; curved plastic troughs being chain-suspended between lamps and ripple-plastic visible-surface paneling. Serving areas and extensive kitchen facilities are complemented by wide range of electric equipment.

A vital safety task:

Testing Conductive Flooring

Effective application of electrically conductive floors for preventing static spark hazards in combustible atmospheres demands periodic testing to assure maintenance of required values of conductivity.

FIG. 1—Test equipment for checking conductive floors.

SAFETY demands that every conductive floor installation be tested for proper conductivity immediately after installation and then regularly on a rigid periodic basis. Only by ascertaining that resistance values of the floor in use are at proper levels can the floor be counted on to perform its vital function of spark suppression in hazardous locations. The following is a review of the problem and a detailed procedure for testing conductive floors.

The problem arises from the hazard of static electricity in areas with combustible atmospheres. Spark discharges of static electricity can cause explosions and fires by igniting explosive gases, combustible vapors, explosive dust or other substances which are combustible in air mixtures. The hazards of such combustions exist and have caused serious explosions in hospital operating rooms and anesthetizing locations and many industrial areas, such as areas where gun powders or combustible solvents or fuels are handled.

Static electricity, which is the source of the problem, is an old phenomenon. It has been observed for over 2,000 years—far predating any type of dynamic electric energy sources—such as battery, transformer or generator. In 321 B. C., Theophrastus knew that pieces of amber when rubbed with dry substances would create sparks and attract feathers and other lightweight particles.

For many years, it was believed that static electricity could only be generated by rubbing friction. It was, therefore, originally known as "frictional electricity." Later experiments proved that static electricity could be generated by bringing together and separating unlike substances, pouring liquids from one container to another, flow of steam from an opening in a pipe, movement of a vehicle on tires of non-conducting material, and movement between contacting surfaces of most dissimilar substances, especially substances that are non-conductors of electricity.

Because of the known and unknown hazards created by static electricity in combustible atmospheres, it is important that accumulation of static electric charges be quickly dissipated. In such areas the use of floor coverings with controlled properties of electrical conductivity (and, often, table coverings) can effectively provide the necessary dissipation of hazardous static charges. For application in hospitals, Bulletin No. 56, "Safe Practice for Hospital Operating Rooms," of the National Board of Fire Underwriters covers the use of flooring for reduction of electrostatic hazard in Section 6. The basic recommendations of this

valuable safety standard are as follows:

"Section 6-1. General.

"The requirements of this section have been formulated for the purpose of reducing the possibility of electrostatic spark discharges and, hence, of the ignition of flammable gases by the energy liberated thereby, and shall be complied with in storage rooms for combustible anesthetic agents located in the surgical suite and anesthetizing locations, in corridors immediately serving the anesthetizing locations and in rooms such as sterilizing rooms, directly communicating with anesthetizing locations.

"Section 2-2. Anesthetizing Locations.

"(a) The term 'anesthetizing location' shall mean any area of a hospital in which it is intended to administer to a patient any combustible anesthetic agent in the course of examination or treatment and shall include operating rooms, delivery rooms, anesthesia rooms, corridors, utility rooms and *other areas if used for induction of anesthesia* with combustible anesthetic agents.

"Note: Hazardous locations require conductive flooring specified in Section 6-2, and electrical wiring specified in Section 5-3. An adjoining area connected by a closeable doorway, such as a corridor, substerilizing room or X-ray control room, where it is *not* intended to store or administer combustible anesthetics, is not considered a hazardous location. Such a location may be wired in accordance with the National Electrical Code for general wiring for ordinary locations. *Conductive flooring is required in such a location to remove static charges from people or objects before they enter the hazardous location.* Recovery rooms are not considered as anesthetizing locations unless specifically intended for the induction of anesthesia.

"Sec. 6-2. Conductive Flooring.

"1. To prevent the accumulation of dangerous electrostatic charges, the surface of the floor in the locations specified by Section 6-1 shall provide a path of moderate electrical conductivity between all persons and equipment making contact with the floor. No point on a nonconductive element in the surface of the floor shall be more than ¼ in. from a conductive element of the surface.

"Note: It is not necessary to provide a special floor-to-ground connection unless required by the authority having jurisdiction."

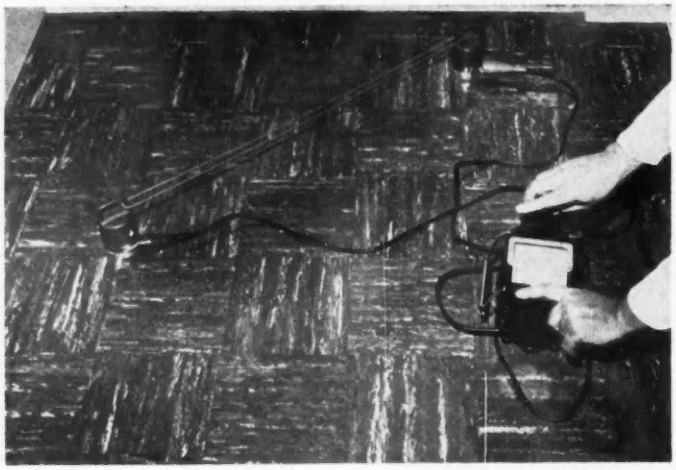


FIG. 2—Resistance measurement between two electrodes spaced 3 ft apart on floor.

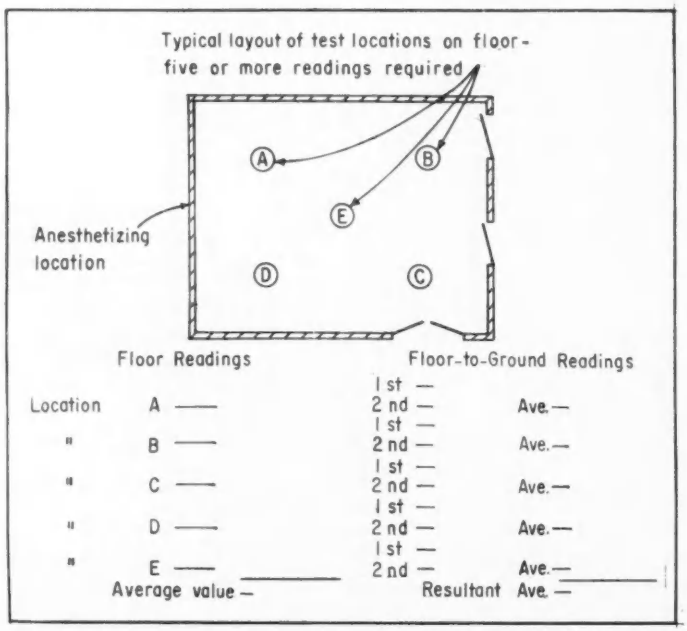

Typical layout of test locations on floor - five or more readings required
A
B
E
D
C
Anesthetizing location
Floor Readings
Floor-to-Ground Readings
Location A — 1st — 2nd — Ave.—
" B — 1st — 2nd — Ave.—
" C — 1st — 2nd — Ave.—
" D — 1st — 2nd — Ave.—
" E — 1st — 2nd — Ave.—
Average value —
Resultant Ave. —

FIG. 3—Room plan showing typical locations for testing conductive floors. A typical tabulating form for use during the test is shown at bottom.

Periodic testing should be made on conductive floors, using the set of test equipment shown in Fig. 1. This consists of two weighted electrodes, test leads and a megohmmeter. Each electrode must weigh 5 lb and have a flat, dry, circular contact area 2½ in. in diameter, comprising a surface of aluminum or tin foil 0.0005 to 0.001-in. thick, backed by a layer of rubber ¼-in. thick. These electrodes are manufactured especially for floor testing. The test leads must be of proper size and length. The megohmmeter used has a normal open-circuit voltage of 500 volts dc and a short-circuit current of 2.5 to 10 ma.

The resistance of the conductive floor itself is measured with the test setup shown in Fig. 2. To assure a conductive path for draining-off or quickly equalizing static potentials, the resistance of the floor must be less than 1,000,000 ohms, measured between two electrodes placed 3 ft apart on the floor.

But, to prevent possible shock, the floor must have a resistance of more than 25,000 ohms measured between the two electrodes on the floor. These limits are based on an average resistance value.

In each room or area, measurement must be made at five or more locations, as in Fig. 3; and the readings must then be averaged. The average reading must be within the limits of resistance specified, i.e., between 25,000 ohms and 1,000,000 ohms. In addition, none of the five test readings may have a value of more than 5 megohms, and none may have a value of less than 10,000 ohms.

Example No. 1—

	ohms
Reading A	4,500
Reading B	40,000
Reading C	60,000
Reading D	15,000
Reading E	2,000
	121,500

$$\text{Average reading} = \frac{121{,}500}{5} = 24{,}300 \text{ ohms.}$$

This floor is unsatisfactory for two reasons:

1) The readings at A and E are less than 10,000 ohms; and 2) the average of the five readings is not in the acceptable range between 25,000 ohms and 1,000,000 ohms.

Example No. 2

	ohms
Reading A	30,000
Reading B	60,000
Reading C	90,000
Reading D	40,000
Reading E	50,000
	270,000

$$\text{Average reading} = \frac{270{,}000}{5} = 54{,}000 \text{ ohms.}$$

This floor is satisfactory.

Where resistance to ground is measured, the test setup shown in Fig. 4 is used. At each of five or more locations in each room, two resistance readings are taken between a ground connection and an electrode placed at any point on the floor. One of the readings at each location is taken, and then the test leads are interchanged at the instrument for taking the second reading. These two readings are averaged for each location. Then the five average readings are also averaged to come up with a single average value of floor-to-ground resistance. None of the average values for the five locations may be less than 10,000 ohms. And the single resulting average value must be greater than 25,000 ohms.

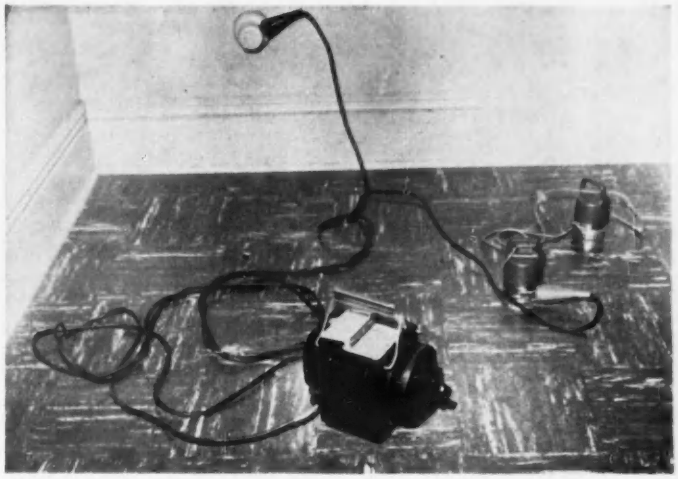


FIG. 4—Test setup for measuring floor-to-ground resistance, from one electrode to a water pipe ground.

Example No. 1—

	reading		avg. ohms
	1st	40,000	
Loc. A	2nd	40,000	40,000
	1st	60,000	
Loc. B	2nd	30,000	45,000
	1st	30,000	
Loc. C	2nd	30,000	30,000
	1st	40,000	
Loc. D	2nd	50,000	45,000
	1st	4,000	
Loc. E	2nd	6,000	5,000

This floor is unsatisfactory due to reading at E which is less than 10,000 ohms.

Example No. 2—

			avg. ohms
Loc. A			40,000
Loc. B	Same as above.		45,000
Loc. C			30,000
Loc. D			45,000
	reading		
	1st	40,000	
Loc. E	2nd	40,000	40,000
			200,000

$$\text{Resultant avg.} = \frac{200{,}000}{5} = 40{,}000 \text{ ohms.}$$

This floor meets all requirements for resistance values to ground.

Section 13 of NFPA Bulletin 56 sets forth a number of specific recommendations to minimize electrostatic hazards. The following rules cover testing and maintenance:

"Testing and Maintenance.

"(a) Conductive Floors.

"1. The resistance of conductive floors shall be initially tested prior to use, by the method described in Section 6. Thereafter measurements shall be taken at intervals of not more than one month. A permanent record of the readings shall be kept.

"2. To be effective the surface of conductive floors shall not be insulated by a film of oil or wax. Any waxes, polishes, or dressings used for maintenance of conductive floors shall not adversely affect the resistance of the floor.

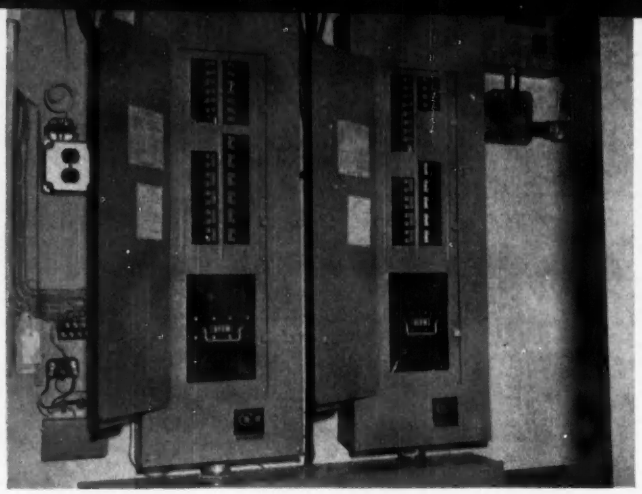
"3. Cleaning procedures for conductive floors shall be established, then carefully followed to assure that conductivity characteristics of the floors are not adversely affected by such treatment.

"(b) Furniture and Equipment.

"1. The resistance of furniture and equipment shall be tested prior to use as described in Section 6. Thereafter measurements shall be taken at intervals of not more than one month. A permanent record of the readings shall be kept. The monthly tests can conveniently consist of measurements of the resistance between an electrode placed on the floor and electrode placed successively on each article of furniture in the room. Additional tests of any individual item should be made if the measured resistance exceeds 5 megohms.

"2. Periodic inspection shall be made of leg tips, tires, casters, or other conductive devices on furniture and equipment to insure that they are maintained free of wax, lint or other extraneous material which may insulate them and defeat the purpose for which they are used; also, to avoid transporting to conductive floors such materials from other areas."

BI-LEVEL RANCH has ten rooms and double garage encompassing 4000 sq ft. 55 kw of electrical heating equipment provides individual room controlled heat. Home has central vacuuming, electronic garage door operator, light-dimming provisions, fire-alarm system, intercom, plus many other special features including a basement fallout shelter.



400-AMP SERVICE is double the size recommended for a Gold Medallion home. Circuits are divided equally between the two 200-amp, 40-circuit panels. Lighting and appliance circuits are at top of panels; heating circuits are at center. Small panel at upper right supplies group-controlled forced-air heaters in game room.

Gold Medallion design inspires . . .

Plus Electrical Home Values

Located in New York's Catskill mountain country, a new all-electric home surpasses Gold Medallion requirements and incorporates a 400-amp service to power a wide range of electrical extras.

WHEN a Gold Medallion installation was proposed for a new $40,000 home, the door was opened for the addition of many extra features which enhance luxurious electrical living.

During the early planning stages, the homeowner indicated to the electrical contractor, Sam Wiener of Liberty, N. Y., that he was interested in a Gold Medallion home. After describing the advantages and conveniences of a Gold Medallion home, Mr. Wiener suggested several additional features which not only supplemented the Gold Medallion design but also added significantly to the comfort and convenience of the homeowner.

Stand-out features selected for this all-electric home include: 1) 400-amp service providing versatility and ample capacity for present and future loads, 2) complete electric heating with heating units both individually and group controlled, 3) light-dimming provisions for downlights in living room and for ceiling fixtures, 4) intercom system with AM/FM radio, 5) zoned fire-alarm system, 6) electronic garage door operator, 7) central vacuuming system, 8) continuous raceway with switched split receptacles in living room, 9) telephone and TV jacks strategically located throughout the house, 10) FM and TV concealed antenna lead-in with preamplifier at the antenna.

In addition there are many other features that add to the desirability of the Liberty, N. Y., home.

A 400-amp service entrance, which is twice the size recommended for a Gold Medallion home, is installed in a service closet off the basement game room. Three 500 MCM RH-RW conductors are carried in conduit from the service-drop attachment to a metering cabinet in the service closet. From the metering cabinet, the 500 MCM conductors extend into a 6-in. wireway where they are spliced to the distribution panel feeders. These feeders are 3/0 conductors which supply two main 200-amp panels.

Protected by pull-out type main fuses, rated 200 amps, the main panels each contain 40 circuits. These branch circuits are protected by circuit breakers. Lighting, appliance, and heating circuits are evenly divided between both panels to provide higher reliability in case one panel must be de-energized.

Sectional baseboard heaters, forced-air units and wall-mounted radiant heaters were selected to heat this bi-level, 4000 sq ft, L-shaped ranch home. All heaters are supplied at 220 volts. Total con-

LARGE BASEMENT GAME ROOM is heated by forced-air units each rated at 3 kw. Low-voltage thermostat and relay supervise heater operation to maintain proper room temperature. In addition, each unit has an integral line-voltage thermostat allowing individual operation.

BUILT-IN ELECTRIC appliances in kitchen include electric range and oven with ducted exhaust hoods. Hoods are retractable; fans turn on automatically when hood is pulled out. Other built-in appliances include automatic dishwasher and garbage disposal.

AUTOTRANSFORMER TYPE light dimmer is adjusted by lady of the house. The 600-watt dimmer controls brightness of pink-lensed downlights in living room. Flush-mounted electronic door chimes over dimmers are connected to operate through intercom system. Receptacle near floor is for the central vacuum-cleaning system.

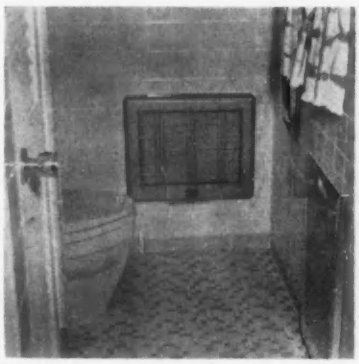
FORCED-AIR HEATER, rated 3 kw, 220 volts, has provisions to delay fan operation until heating elements have warmed up allowing only warm air to be circulated. Behind Carl Intemann, Liberty Electric Co., a low-voltage thermostat for control of game room heaters and an intercom remote station can be seen. Quiet switches were also installed.

INTERCOM MASTER PANEL controls are explained by electrical contractor, San Wiener. Intercom system has seven remote stations including one outside unit at front entrance. AM/FM radio and door chimes are connected into the system. Home also features a zoned fire-alarm system with test panel and fixed-temperature fire detectors.

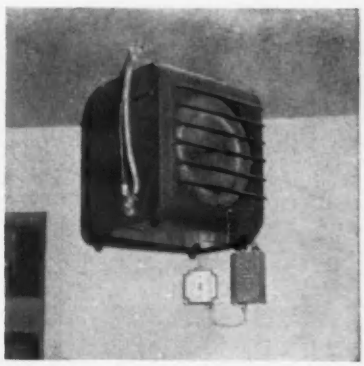
nected heating load is 55 kw.

Baseboard heaters were selected for living areas and bedrooms. Where heat losses are higher, such as at entrances and at patio glass doors, forced-air units were installed. In addition, forced-air units provide heat for the large basement game room. Radiant heaters are installed in bathrooms.

Effective insulation is installed. In the ceiling, 6-in. glass fiber batts are backed by a polyethylene vapor barrier. Walls are insulated with 4-in. glass fiber batts with integral vapor barrier. Under the basement floor, a polyethylene barrier precludes dampness. Since the basement is used as a living area, basement walls were also insulated with glass fiber batts. In addition, double-paned glass was installed.



RADIANT HEATER, rated 2 kw, 220 volts, was selected for bathroom. Because moving air, even though heated, tends to feel cool on wet skin, the radiant type was preferred over the forced-air heater. Sectional baseboard heaters were installed in living areas and in bedrooms.



7½-KW FORCED-AIR UNIT heats double garage. Louvers can be adjusted to direct strong blast of warm air to any level. Also installed in the garage are fire alarm detectors, the electronic overhead-door operator, booster amplifier for TV and radio reception, and the central vacuuming unit.

A detailed study on . . .

Minimizing Transformer Noise

Here's important data for designers and constructors on the problem of minimizing hum from dry-type transformers installed indoors where noise intrusion on quiet areas—schoolrooms, offices, library—would be objectionable.

By F. J. Brutt and A. A. Moosally, *Westinghouse Electric Corp., Sharon, Pa.*

THE problem of transformer noise arises from the character of today's buildings. Modern application of higher distribution voltages in buildings more and more dictates the installation of transformers in close proximity to people. In particular, the use of 460Y/265-volt distribution in commercial and institutional buildings has brought widespread use of local stepdown transformers. With this use has come an awareness of and demand for control of the hum produced by transformers. This is especially true where such hum intrudes on areas of human occupancy which are normally quiet—those with a low normal ambient sound level—such as schoolrooms, study areas, libraries, hospital areas, many offices, etc.

It is a basic law of electricity that when an alternating current is passed through the windings of a transformer, an alternating flux is generated in the magnetic core of the transformer, and the core material is subjected to alternating strain. This is commonly known as magnetostriction and creates vibration forces in the transformer core and coil assembly.

The mechanical vibrations produce a sound having a fundamental frequency of twice the electrical frequency. In a 60-cycle transformer, then, the fundamental frequency would be 120 cycles. Normally, one would imagine that only 120-cycle frequencies would be generated. However, due to a nonlinear relationship between magnetostriction and flux density in actual cores, a number of harmonically related higher frequencies are produced (240, 360, 480 cycles, etc.). The ear is much more sensitive to the higher frequencies. However, these higher-frequency harmonics in present grades of electrical sheet steel, are low and their contribution to sound audibility is almost negligible.

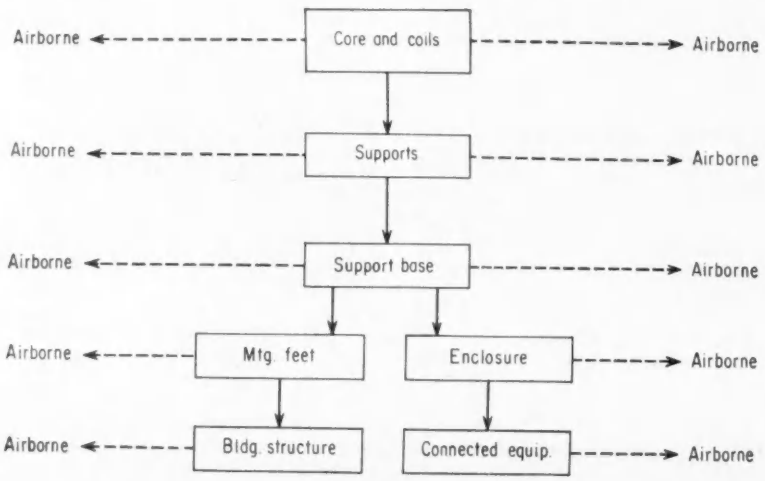


FIG. 1

Vibrations Are Transmitted

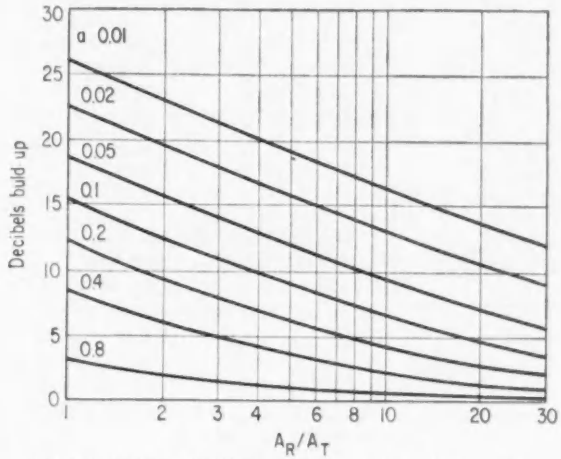
There are three principal ways in which transformer sound may reach an observer:

1. The sound may travel by an all-air path. This includes reflected waves which are indirectly on an all-air path.

2. The vibrations may be transmitted to the building structure and radiated as sound waves at locations distant from the transformer.

3. The sound waves may impinge on a wall or other barrier causing it to vibrate. The vibrations may be transmitted to the opposite side of the wall or panel and then radiated as sound to the adjoining areas.

In most applications all three methods of sound transmission are encountered. In the modern design of dry-type transformers, a coil and core assembly is a very compact-solid arrangement so that one can consider that together they are the sound-producing source. Assuming the core and coil assembly as the sound-producing source, the generated vibrations are either radiated as air-borne sound or transmitted



SOUND LEVEL BUILD UP FOR INSIDE LOCATIONS

FIG. 2

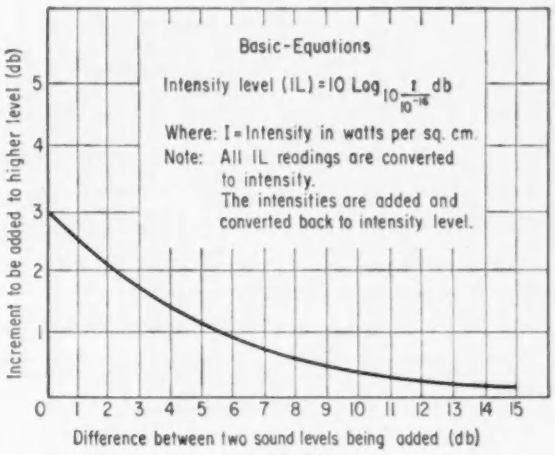

Basic-Equations
Intensity level (IL) = 10 Log $_{10}\frac{I}{10^{-16}}$ db
Where: I = Intensity in watts per sq. cm.
Note: All IL readings are converted to intensity.
The intensities are added and converted back to intensity level.
Increment to be added to higher level (db)
0
1
2
3
4
5
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Difference between two sound levels being added (db)

FIG.3

as structure-borne vibrations. From the sound source, the transmitted vibrations are passed to the mounting supports where part will be radiated as air-borne sound. This continues until the remaining structure-borne energy is transmitted to the building structure and connected equipment. (Fig. 1).

Control of Vibrations

In transformer design there are two basic ways to reduce the magnitude of the audible sound level:

1. Reduce the magnitude of the generated vibrations.

2. Attenuate these vibrations with suitable dampening devices before they are radiated as air-borne sound.

To reduce the magnitude of the generated vibrations, one must first understand that the magnitude of the sound-producing vibrations is a direct function of the core flux density and the length of the flux path. The magnitude of the vibrations will increase directly with the flux density and the length of the flux path.

In one design approach, two basic methods are used to control the sound-producing vibrations. Using high density, grain-oriented steel, and high temperature insulation, a minimum size core loop is accomplished with minimum core cross-sectional area. Minimum vibration magnitude is achieved together with the smallest, lowest weight core possible. With this design, vibration control is obtained without increased transformer size and weight.

Attenuation of structure-borne vibrations is the second consideration in the explanation of low sound-level designs. If the structure-borne vibrations are allowed to pass to the transformer mounting base, mounting feet, case and associated equipment, a sound level increase will result. This is due to equipment and components being driven and the resulting vibrations radiated to actually amplify the sound level of the transformer itself. These structure-borne vibrations are isolated by use of two spring mounts located immediately between the core and coil assembly (sound source) and the transformer mounting base and case.

Structure-Borne Vibrations

Most specifying engineers define a maximum air-borne sound level of transformers to assure compatibility with the ambient sound level expected in their particular application. These limits are based on NEMA sound level test procedure which dictates a test ambient level, position of microphones, meter limitations, etc.

Proper testing of audible sound level is done in an anechoic chamber with very low ambient levels. If such a test facility is not used, extraneous results can be obtained. In such a test facility, the transformer is placed within the chamber, free standing. The unit is energized and the sound level recorded. Under these ideal conditions, there is essentially no increase in sound level caused by structure-borne vibrations.

If we assume that the transformer meets the specified air-borne sound level and no consideration is given to the structure-borne component, installation of the transformer can increase the sound any number of decibels depending upon the construction of the installation. It is not at all surprising to experience sound level increases of 10 to 20 decibels.

Some engineers will attempt to isolate these structure-borne components by specifying that the transformer be mounted on suitable vibration dampeners. Such dampening devices can be of great help in reducing the sound level buildup. However, one must recognize that they do not isolate the transformer base, case, conduit, and associated equipment. These can still vibrate and radiate air-borne sound even though the structure-borne vibrations are isolated from the main building structure. These vibrations can be transmitted to the case and connecting conduit throughout the building and result in very objectionable sound levels. Even if the engineer specifies flexible conduit connections to the transformer, he still has not isolated the transformer enclosure. This is very important since the magnitude of radiated sound is directly dependent upon the area of the radiating surface, and the transformer enclosure is the largest surface area found

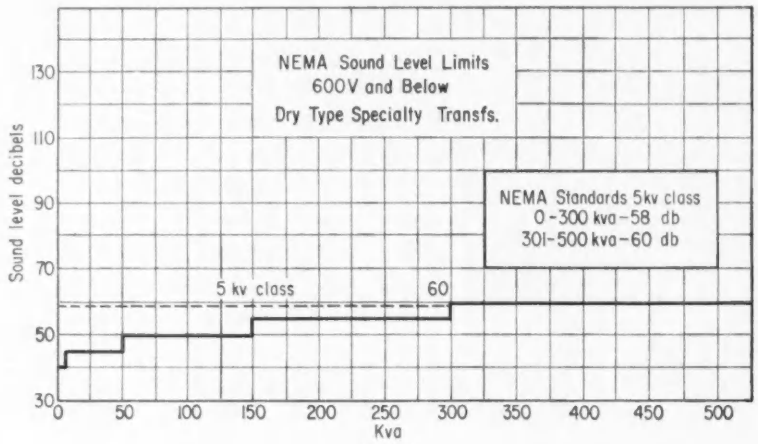


FIG. 4

among the transformer components. Thus, this can become a very large contributory source to audible sound level.

It is obvious, then, that the proper place for isolation is immediately following the actual source of the vibrations. This is directly between the transformer core-and-coil assembly and the mounting base and case. Flexible coupling of conduit and auxiliary dampeners can still be used as further protection against sound-level buildup. With internal suspension, however, elimination of external isolators will show the least effect on the over-all performance of the transformer installation.

The audibility of sound is affected by:

1. Frequency
2. Ambient sound level
3. Nature of the surroundings
4. Distance between the observer and the sound source.

The frequency considerations have been discussed briefly in other parts of this article and will not be treated further. The ambient sound level and its masking effect is of prime importance and should be considered.

Masking

It is common experience to have one sound made completely inaudible when another louder sound occurs. The reverse effect also happens. For example, in an office with air conditioning, the ambient sound level during the day, when activity is at its highest, completely masks the sound generated by the air conditioning system. However, should one return at some other time, when there are no typewriters or telephones in use of people engaging in conversation, the sound level of the air conditioning equipment is very objectionable. Actually, the sound level of this equipment is no different in the two cases. Psychologically, the noise appears louder because there is less of the masking effect of the ambient noise which would reduce the apparent loudness of the air conditioning machinery.

The following can be used as an approximate guide for usual transformer and background noise calculations:

"If the sound level of the transformer is 10 DB lower than the background sound, the transformer will be inaudible."

Nature of Surroundings

If the transformer were placed in an ideal room with walls that were perfectly sound-absorbing, there would be no reflected sound level in the room. Under this condition, the sound level of the transformer would be the same as if the transformer were located outdoors away from any reflecting surfaces. This is essentially the sound level the manufacturer would report for a transformer measured according to NEMA Standards.

It is not possible to reduce the sound level of a transformer in such a room below this figure. In a room with walls of low absorption, however, the sound from the transformer will reflect back and forth between the walls resulting in an increase in the sound level. The number of decibels the sound level is increased right at the transformer is approximately:

$$\text{DB (Build Up)} = 10 \text{ LOG}_{10} \frac{(1 + 4\,(1 - a)\,A_T)}{aA_R}$$

Where: A_T = Surface area of the transformer
A_R = Surface area of the room
a = The average absorption coefficient of the inside surface area of room.

If the walls absorb sound well, the absorption coefficient approaches one and the buildup is zero. If the area of the room is large, again, the buildup is zero.

The absorption coefficient for the room is calculated as follows if various materials are used on different surfaces of the room:

$$a = \frac{a_1A_1 + a_2A_2}{A_R}$$

Where: "a" and "A" are the absorption coefficient and area respectively of a particular surface.

Most of the sound from transformers supplied from a 60-cycle current is at 120 cycles. For very small transformers, this may not always be true, but it will be conservative to assume so. The values of the absorption coefficients used should be at 120 cycles (or 128 cycles as most tables give) instead of the sound reduction coefficient which is the average of the absorption coefficients at 256, 512, 1024, and 2048 cycles. Usually the absorption of 128 cycles is low compared to higher frequencies. Transformers are quite often put in rooms with walls made of poor sound absorbing materials. For instance, poured concrete has an absorption coefficient of .01 at 120 cycles per second. Let us consider a room with dimensions 6 by 10 by 10 and assume the absorption to be .01. We have a room surface area of 440 sq ft and a volume of 600 cu ft. Assuming a transformer surface area of 21 sq ft (based on a 75-kva dry-type transformer), the DB buildup would be approximately 13 DB. The table below shows the buildup if the room volume is doubled, tripled and quadrupled. For values of DB buildup versus A_R/A_T, refer to Fig. 2.

Linear (ft.)	Volume ($ft.^3$)	Surface Area ($ft.^2$)	Sound Level Buildup (DB)
10x10x6	600	440	13.0
10x10x12	1200	680	11.2
10x10x24	2400	1160	9.1
10x20x24	4800	1840	7.4

All figures are based on transformer surface area of 21.1 $ft.^2$ and absorption coefficient of .01.

The equation for the buildup and Fig. 2 apply to the sound level right at the transformer. At a distance "r" from the center of the transformer, the sound level is approximately:

$$\text{Sound Level DB} = SL_0 - 10\ LOG_{10}\frac{A_T}{4\pi r^2} + \frac{4\,(1-a)\,A_T}{aA_R}$$

Where: SL_0 = Average sound level of transformer when tested per NEMA Standards
r = The distance from the center of the transformer

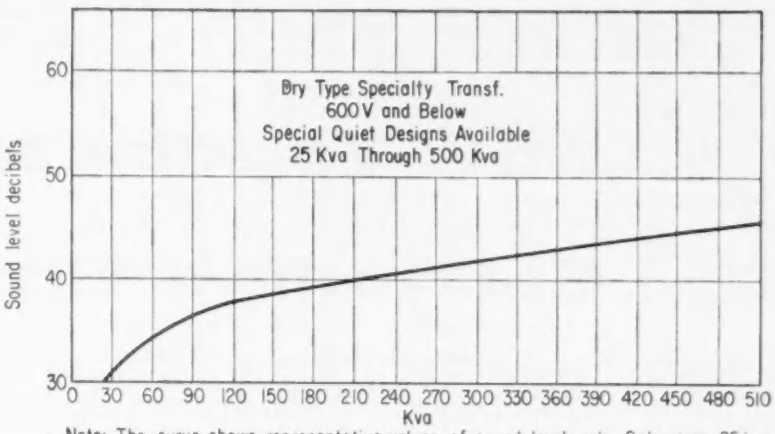
To calculate "r" the transformer is considered a sphere of radius r_T such that:

$$4\pi r_T = A_T$$

The distance "r" then is the sum of r_T and the distance from the transformer of the field point. For practical purposes, "r" is the distance from the geometrical center of the transformer to the field point. If the buildup of sound level at the transformer is larger than three DB, the sound level is essentially uniform throughout the room. These equations apply essentially to a transformer toward the center of a room with irregular walls. If this is not the condition, standing waves and focusing will result in some variations from the calculated values at various places about the room.

Proximity Effects

The foregoing calculations do not take into consideration the proximity effects of the room. By this we mean how close the transformer is mounted to a reflecting surface. If a transformer is suspended in the center of an available space, then the reflecting medium is a complete sphere. However, if the transformer is lowered to the floor in the geometrical center, then the transformer sound impinges on one plane, and this reduces the radiating space to a hemisphere. If the transformer is moved to a corner where there are two reflecting surfaces, then the radiating space is reduced to a quarter of a sphere. Such an area would be a wall and a floor. If the transformer is mounted in a full corner, which would have three reflecting surfaces, then the radiating space is reduced to one-eighth of a sphere. In each of these cases (hemisphere, quarter sphere and one-eighth sphere, respectively), the sound level buildup for dry-type distribution transformers would be approximately 1½, 3 and 4½ DB more, respectively, than by the formulas above or by Fig. 2.



Note: The curve shows representative values of sound level only. Only sizes 25 kva and above are considered here.

FIG. 5

Two or More Transformers

When two or more transformers are placed within the same room, there is naturally a sound level addition. This addition is not a numerical addition or an average of the two or more sound sources. To make this addition, the sound levels at a given point due to each transformer should be computed by the formulas given previously. Then the sound intensity for each can be computed from the decibel values, the intensities of the various sounds are totaled, and the decibel value of the total sound computed from the total intensity. The decibel value and intensity are related by this formula:

$$DB = 10\ LOG_{10}\ I/10^{-16}$$

Where: I is in watts per sq cm.

Fig. 3 is a curve for totaling two sounds, based on the above relationships. This curve can be used to total any number of sounds by first totaling two of the sounds, then the subtotals combined with a third, the new total with a fourth, etc.

Transformer Sound Level

The National Electrical Manufacturers Association (NEMA) and the American Standards Association (ASA) have established certain maximum values of sound level according to kva size and voltage class; see Fig. 4 for the dry-type distribution classes. In almost every installation, transformers meeting these limits will have sound levels which amply satisfy the application needs. However, in Fig. 5 a curve of sound level versus kva is given for a special quiet line of transformers. Such low sound level transformers are only necessary in very special circumstances. They might be a waste of money *in many applications* since standard "off-the-shelf" apparatus will be more than sufficient if the recommendations of the manufacturer are followed.

Sound amplification can be greatly reduced by using the following general suggestions for installing indoor transformers:

1. The transformer should, where possible, be installed in an area where the sound level would be the least objectionable.

2. Nearby reflecting objects or enclosures which will resonate or echo should be avoided as well as mounting the units in areas which tend to amplify voice such as stairways and hall areas.

3. Tile, brick, concrete, masonry, or steel walls as well as floors and ceilings are poor sound absorbers and should be avoided whenever possible. Acoustic absorbing materials may have to be used to reduce excessive sound buildup.

4. Avoid mounting the transformer on walls, partitions, balconies, floors, etc., having light mass. If the weight of the mounting surface corresponding to the projected area of the transformer is greater than or equal to the weight of the transformer, the possibility of amplifying the sound waves in the structure will be greatly reduced.

• *ESTIMATING FORUM—XX*

How To Allocate Estimating Time—Part I

Hours Per $1,000 of Contract Base Cost Method

By Ray Ashley, Research and Consulting Engineer, Oak Park, Ill.

STATEMENT:

An important function of good electrical contracting management is the accurate allotment of time for estimating individual projects. Expeditious use of the estimating department is dependent on this function.

A study, in two parts, will be made of possible methods of allocating estimating time. This first article will investigate the hours per $1,000 of base job cost method which has been used by some contractors.

QUESTIONS:

1. ***How many estimating man-hours did contractors allow per $1,000 of contract base cost when the mechanic's rate was $3.00 per hour?***
2. ***What are the three principal reasons why this particular method is not generally applicable?***

ANSWERS:

1. ***Two hours of estimating time per $1,000 of contract base cost.***
2. ***This method is not generally applicable because:***
   - ***a) The units are only temporary.***
   - ***b) If the units are applicable to complete installations, they are too low for installation-only work.***
   - ***c) Given units apply to contracts in a very limited bracket.***

DISCUSSION:

A Temporary Unit

The unit, two hours per $1,000, was established for a limited number of contracts when the mechanic's rate was $3.00 per hour. It was applicable to large, well-engineered projects.

In these times of rapid inflation, the unit—hours per $1,000—declines rapidly. At two hours per $1,000, estimating time for a $30,000 base-cost project would be 60 hours. Suppose prices are inflated one-third. The same project would then have a base cost of $40,000, but the estimating time would still be 60 hours. The unit would then be 1.5 hours per $1,000.

Unit Check

Fig. 1 has been developed to provide a check on the two-hour unit. It gives estimating costs in percentage of contract base costs for two rates of estimators' pay.

A rate of $4.00 per hour for the estimator was used in Example I. Cost of estimating the job was 0.8% of the base cost of the contract.

In Example II, a $3.50 per hour rate was used for the estimator. Here, the estimating cost was 0.7% of the contract base cost.

The average cost for Examples I and II is 0.75% of contract base cost. This checks with values given for the better projects listed in "A Study of Estimating Costs" published in the April 1960 issue of *Electrical Construction and Maintenance.*

Installation-Only Projects

It is general knowledge among electrical contractors that the time required for estimating installation-only projects is practically the same as that for jobs where the contractor is to supply the materials along with labor and installation services. In the following comparison, we will assume that the time is the same. Detailed discussion of installation-only costs can be found in "Electrical Contracting" (McGraw-Hill Book Co.).

Fig. 2 shows two cost estimates of the same project. One is based on a complete installation (material and labor). The other is for installation-only (material furnished by owner). Both require the same number of estimating hours, since material and equipment quantities must be noted to establish labor hours.

Example 1-A (Fig. 2) is a complete installation with a sell price of $13,365 and a base cost of $10,000 ($6,000 material, $4,000 labor). On the basis of two hours per $1,000 of base cost, estimating time is 20 hours (2 times 10).

Example 1-B (Fig. 2) is the same project figured on an installation-only basis (material furnished by owner) and carrying a sell price of $7,091. The same 20 hours would be required to estimate the job. But here the cost is $4,000 (labor only). Hence, the estimating hours per $1,000 of base cost would be 20/4, or 5 hours. Compare this with the 2-hour unit in Example 1-A.

The logical conclusion is that a generally applicable estimating-time unit should be based on job-labor hours instead of job base cost.

Limited Application

Experienced estimators know that estimating-time units, like labor units, are standards which must be adjusted to suit the job at hand. The foregoing shows that the "hours per $1,000 base cost unit" is subject to too many variations to permit ready application to a large range of projects. In the next article, a unit based on job-labor hours will be studied.

Fig. 1—Check on Estimating Costs

Based on 2 estimator-hours per $1,000 of contract base cost*

Project Cost Data

Contract price (sell)	$12,000
Estimated base cost (0.75 × 12,000)	9,000
Material/labor ratio—60/40	
Base cost—material (0.60 × 9,000)	5,400
Base cost—labor (0.40 × 9,000)	3,600
Estimated hours to figure job: $\frac{9{,}000}{1{,}000} \times 2 =$	18 hours

* Mechanic's rate of pay—$3.00 per hour.

Example I—At $4.00 per hour rate for estimator

Cost of estimating—dollars (18 × 4)	$72.00
Cost of estimating—percent of base cost $\frac{72}{9{,}000} =$	0.008

Estimating cost equals 0.8 % of contract base cost.

Example II—At $3.50 per hour rate for estimator

Cost of estimating—dollars (18 × 3.50)	$63.00
Cost of estimating—percent of base cost $\frac{63}{9{,}000} =$	0.007

Estimating cost equals 0.7 % of contract base cost.

Fig. 2—Estimating Time

Complete vs. Installation-Only Projects

Example 1-A Complete Installation (base cost $10,000).

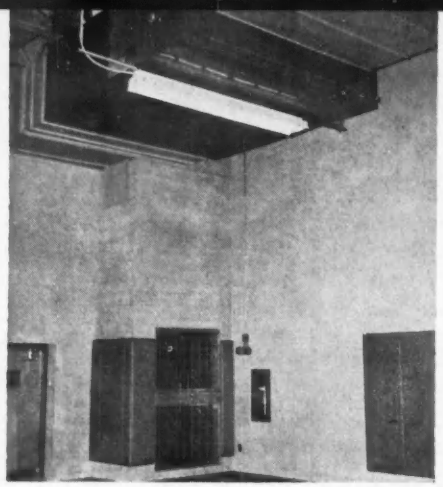
		MATERIAL		LABOR
Base costs		$6,000		$4,000
Direct job costs	2%	120	6%	240
Complete job costs		6,120		4,240
Overhead	10%	612	35%	1,484
		6,732		5,724
Return	5%	337	10%	572
Sell material		$7,069		$6,296
Sell labor		6,296		
Sell the job		$13,365		

Estimating time at 2 hrs. per $1,000 of base cost—20 hrs.

Example 1-B Installation-Only Project (base cost $4,000).

	MATERIAL		LABOR
Base costs	($6,000) by owner		$4,000
Excess labor (I-O contract)		10%	400
Total job labor			4,400
Direct job costs		6%	264
Complete job costs			4,664
Overhead		35%	1,632
			6,296
Material service (2½% of $6,000)			150
			6,446
Return		10%	645
Estimated sell price			$7,091

Estimating time (see Example 1-A)—20 hrs.
Estimating time per $1,000 base cost (20/4)—5 hrs.



73-KW HEATING AND VENTILATING UNIT is one of two that heats and ventilates the 8000-sq-ft gymnasium. Return air enters shaft at bottom, mixes with outside air in plenum at unit, is heated and discharged into area.

FOUR UNIT VENTILATORS, each rated approximately 30 kw, condition the 3400-sq-ft cafeteria. Floor-mounted on outside walls to facilitate fresh-air intake, similar units, each rated approximately 15 kw, heat and ventilate classrooms and laboratories. Units are supplied at 480 volts, 3-phase.

In New Jersey "Icebox" country . . .

Electric Heat For High School

Design, application and installation details for a large, modern all-electric high school using over 1500 kw of various types of space heating equipment. Featuring an extensive control system to minimize operating costs, this electric heat installation saved nearly $70,000 from initial expenditures and is expected to save over $1,000 operating dollars per year.

By Robert J. Lawrie

LOCATED in the "icebox" country of Northern New Jersey where winter temperatures drop below zero, the recently completed all-electric Roxbury High School at Succasunna affords a distinct illustration of how electric heat provides more advantages at lower costs.

For example, students and teachers enjoy greater safety, dependability, cleanliness and comfort. Taxpayers benefit from a lower indebtedness and interest charges because initial costs were reduced by nearly $70,000.

Moreover, operating costs are expected to be minimum. Taking all factors into consideration, this electric heat installation is expected to save over $1000 per year in operating costs. These operating savings were based on several significant factors including: initial savings and interest; comparatively low electric rate (1.8 cents per kwhr); dollar value assigned to classroom space gained by eliminating boiler room, boilers and associated equipment; savings gained by eliminating boiler attendants and boiler maintenance; and reduced insurance rates.

In addition, flexibility of the electric heat installation was evaluated because of the greatly reduced cost of enlarging the heating system when planned future classrooms are added.

Also considered was the lower cost of operating the electric heat system on cool days when only a small amount of heat is needed or to heat a single room or area during a Christmas vacation or on other similar occasions.

Because the 87,000-sq-ft high school has facilities to meet practically all ramifications of modern education, heating methods varied considerably. As an example, large heating and ventilating units (73 kw) condition the gym and auditorium. In classrooms and laboratories, unit ventilators provide both heating and ventilation. For supplementary heating and for smaller areas, both baseboard heaters and wall convectors were selected. At entrances and in corridors, forced-

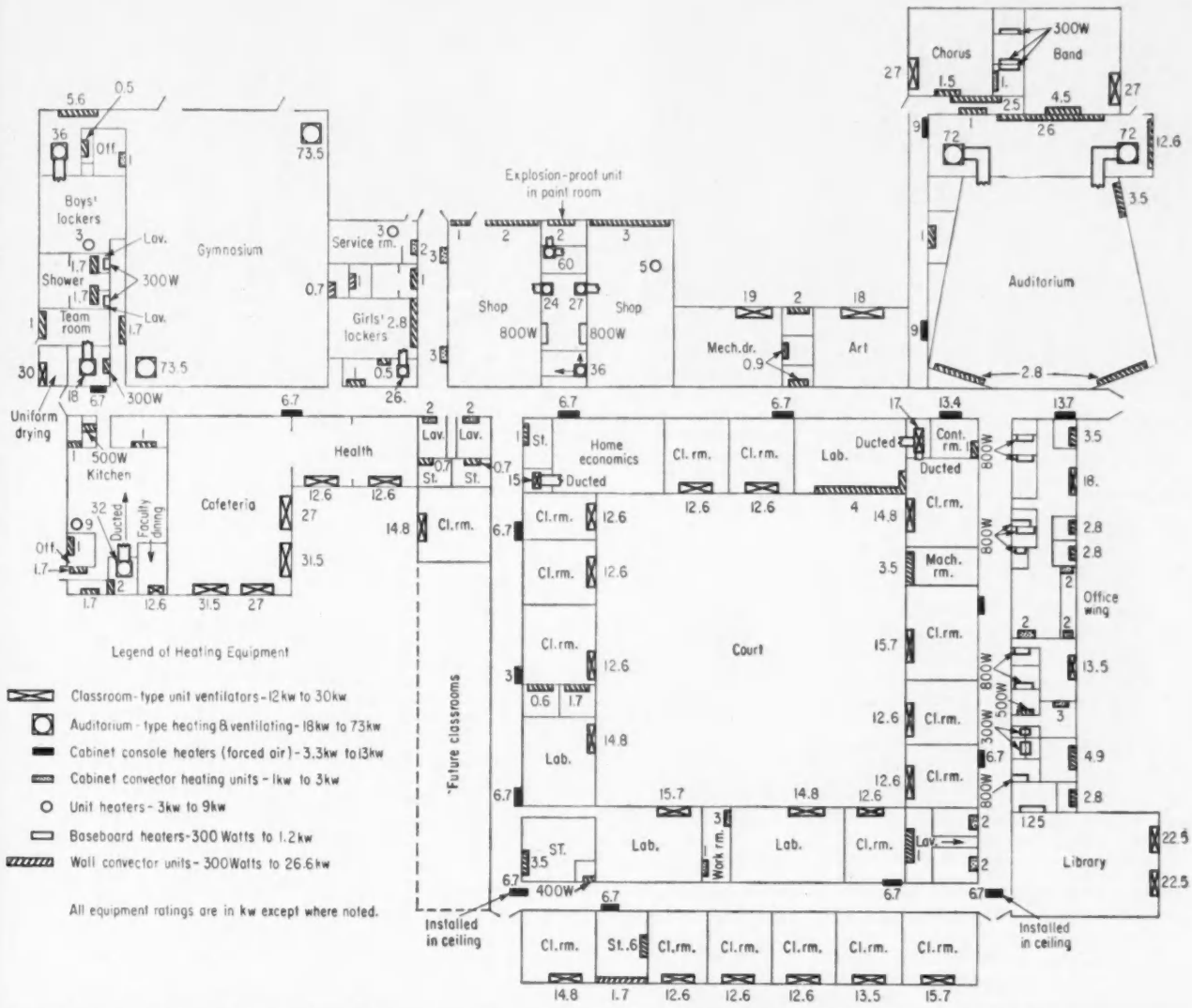
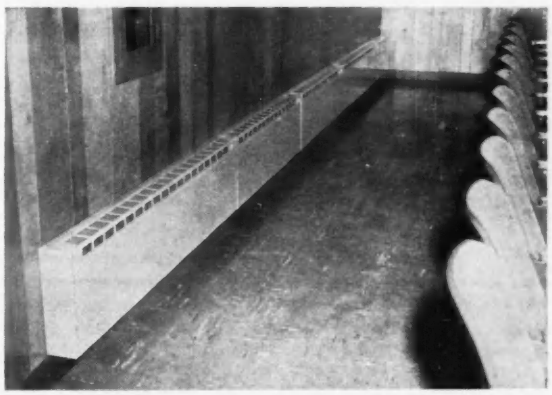
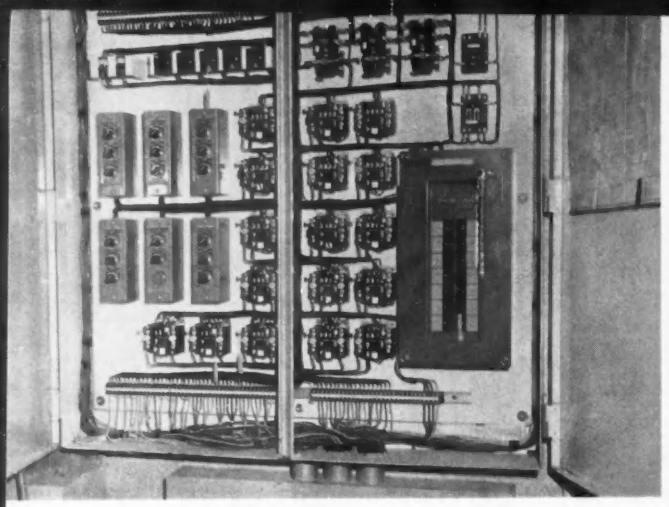


FIG. 1—Floor plan of Roxbury High School shows location and power ratings of the seven different types of space heating equipment. The 152 separate installations account for 1558 kw of the total connected load of 2155 kw. Various types of equipment and application methods provide optimum environment conditioning.

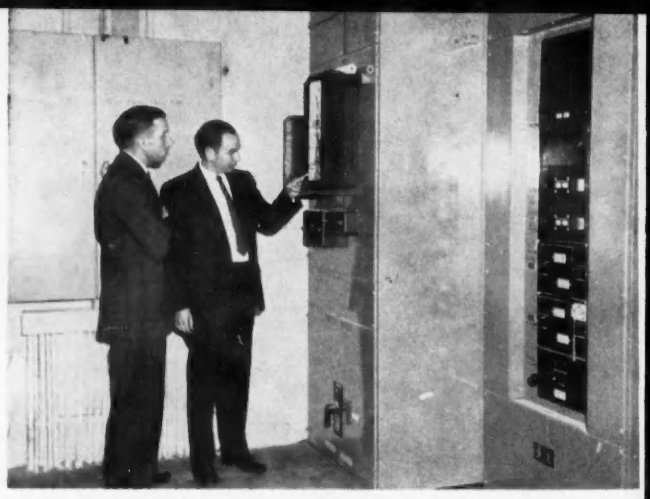
FORCED-AIR UNITS provide high-capacity heat in corridors, lobbies, entrances or in other areas where heat losses are comparatively high. Rated 6.7 kw, this unit is connected at 480 volts, 3-phase.



WALL CONVECTORS supply supplementary heat in auditorium. Main heat is supplied by two 73-kw heating and ventilating units through ducted diffusers. Wall convectors shown are rated 2.8 kw and are connected at 277 volts.



TEMPERATURE CONTROL PANEL is one of six which controls heating equipment and vent fans. TCPs are indexed for day, night or warm-up operation from a master clock-supervised panel. Panel shown controls the gymnasium zone. Switches at top left can be set to override master system supervision for manual control of the zone.



RECORDING DEMAND METER is examined by A. W. Rottner, applications engineer (left) and G. F. Ledder, New Jersey Power and Light Co. Demand meter provides means for checking proper operation of control system. Main circuit breaker can be seen below metering compartment. Molded-case circuit breakers (at right) protect main feeders.

air units afford space heating. And, in the paint shop, an explosion-proof unit was required.

To meet State requirements for ventilation, many units perform the dual service of heating and ventilating. In addition, these combination units can be used for natural cooling in warm weather. However, because the State insists on maximum ventilation for schools, most heating equipment selected is of maximum kw for the space it serves.

Heating equipment and exhaust fans are automatically controlled through a master panel and local control panels. Also, units may be individually controlled through their respective "day" or "night" 120-volt thermostats mounted nearby. Main-power step contactors or heavy-duty mercury switches, thermal cutouts, circuit-breaker disconnect devices, and control relays are installed within the enclosure of each heating equipment or mounted nearby.

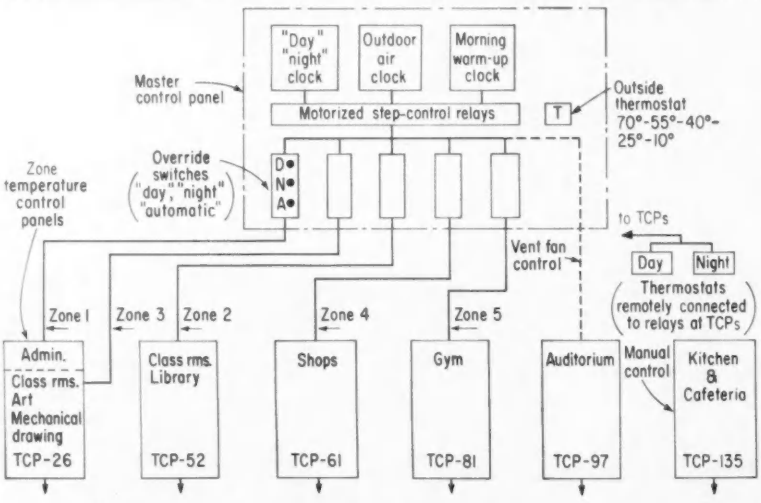


FIG. 2—Automatic control system for heating equipment and exhaust fans incorporates a master control panel, six local temperature control panels and relays or thermostats, which are installed near or within each unit. A 72° F temperature, maintained during the school day, is controlled by the "day" thermostat. "Night" thermostats maintain a 60° F to 65° F temperature from 3:30 PM to 4:00 AM. During the warm-up period (4:00 AM to 8:30 AM) each zone is returned to 72° at 48-minute intervals, which minimizes kw demand. The outside thermostat varies temperature control according to outside air temperature. Manual override switches are provided at all control panels.

Adequate insulation minimizes heat losses in winter and reduces heat gain in summer. To reduce heat loss through glass areas, all windows are double paned (½-in. air space between panes). Entrance doors have ¼-in. thick wire glass and are weather-stripped.

For perimeter insulation, 1½-in. thick polystyrene was installed 4 in. high and 2 ft horizontally under the slab. A vapor barrier of polyethylene film was installed under the entire slab. Expanded polystyrene insulating boards, 2 in. thick, insulate all outside walls. These boards are installed in the 3-in. space between the outside brick and concrete blocks allowing the remaining 1 in. of air space to act as additional insulation.

Effective roof insulation was economically accomplished by installing pre-cast concrete roof slabs which were supplied with 2-in. thick insulating fiberboard embedded. Air space in the false ceiling provides additional insulation.

Heating and Ventilating Units

Auditorium-type heating and ventilating units, designed to condition large volumes of air, operate at 480 volts 3-phase and range in size from 18 to 73 kw. In the 8000-sq-ft gymnasium, two 73-kw units installed overhead provide heating and ventilating directly into the area. Controlled by motorized dampers, return air and fresh outside air are mixed in a modulating plenum prior to being heated and discharged into the gym. In other large areas, such as the audi-

torium, kitchen, and shops, similar units serve their respective areas through ductwork and diffusers.

Unit Ventilators

Classroom-type heating and ventilating units range in size from 12 to 30 kw, operate at 480 volts and incorporate fresh-air intake ducts for space ventilation. Mounted on outside walls to facilitate fresh-air intake, these units serve classrooms, laboratories, the library and other limited-space areas where students congregate. A motorized damper controls fresh-air intake; heating elements are step controlled by the room thermostat subject to master control supervision.

Cabinet Forced-Air Units

Mounted flush or semi-recesssed in wall space, forced-air cabinet-type heaters provide high-capacity heat in the lobby, corridors and at entrances. Connected 480 volts, 3-phase, these units range from 3.3 kw to 13.7 kw according to the heat loss in their respective areas.

Cabinet Convectors

Cabinet convectors ranging in size from 1 kw to 3 kw serve spaces where heating requirements are nominal and where units possibly may be subjected to abuse. Connected 277 volts single-phase, these units are wall-mounted in lavatories and in small offices. They were also selected for areas where wall space was insufficient for baseboard-type heaters.

In other instances where wall space is limited, unit heaters mounted overhead are used.

Baseboard Heaters

Low-wattage baseboard heaters, operating at 277 volts single-phase, serve small areas such as waiting rooms, small offices and storage rooms. These units are installed in multiples of 2-, 5- and 8-ft lengths. Installations range from 300 to 1250 watts.

Wall Convectors

Wall convector installations heat various sized areas. Connected at 277 volts, single-phase, these sectional units (2- to 6-ft unit lengths) are mounted in tandem forming installations which provide from 300 watts to 26.6 kw of heating. When mounted under window sills in classrooms and offices, these units are effective as draft barriers. At the back of the stage, in locker rooms, or in other areas where students are active, they are mounted at eye level.

In the auditorium and in some laboratories and shops, wall convectors supplement the main heat source, which is ducted from large heating and ventilating units.

Control System

To minimize kw demand and operating costs, an extensive control system regulates heating equipment and exhaust fans. This system incorporates *day-night control*, which allows room temperature to be set back automatically during unoccupied periods; *morning warm-up*, which brings room temperature to 72° F but does not allow ventilation during warm-up; *zone control*, which permits staggered morning warm-up to minimize kw demand; and *outside-air control*, which regulates the entire system according to outside air temperature.

In addition, each equipment is thermostatically controlled providing individual operation of each area served. Manual control is possible when particular areas or rooms are to be used "after hours" or during unscheduled events.

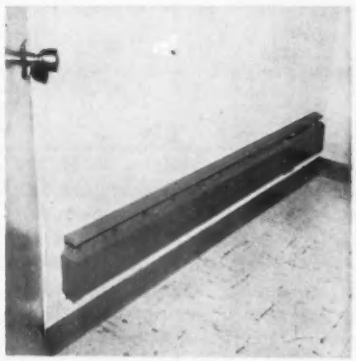
Major components of the control system (see Fig. 2) include a master control panel, six local temperature control panels installed in their respective areas, and individual controls on each equipment. Mounted within the master panel, a "day-night" clock, an "outdoor air" clock, and a "morning warm-up" clock are the heart of the control system.

From 8:30 AM to 3:30 PM, the "day-night" clock indexes the temperature control panels for normal "day" operation of vent fans and all heating units to obtain a constant 72° F temperature. From 3:30 PM to 4:00 AM, "night" control permits operation of heating units to maintain a 60° F to 65° F temperature. At 4:00 AM, the "morning warm-up" clock indexes each zone temperature control panel, one every 48 minutes, until each zone reaches the preset temperature of 72°. This allows a staggered warm-up period, preventing excessive equipment operation at one time, thus minimizing kw demand.

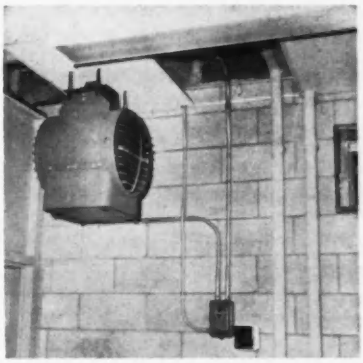
The "outdoor air" clock prevents operation of all exhaust fans and holds fresh-air dampers in their closed position during the night cycle and during morning warm-up. During the day cycle, ventilation operates according to area needs.

Override switches, located in each temperature control panel, allow manual control of each area. Heating equipment in the auditorium and in the kitchen-cafeteria area is not supervised by the master control panel. This equipment is controlled from their respective temperature control panels.

(Continued on page 189)



BASEBOARD HEATERS are supplied at 277 volts, 3-phase. These units serve small areas such as waiting rooms, small offices or storage areas. Sections of 2-, 5- and 8-ft lengths are installed in tandem to provide from 300 to 1250 watts of space heating.



UNIT HEATER provides additional heat in kitchen. Louvers can be adjusted to direct strong blast of warm air to any level. Unit shown is 9 kw and is connected at 480 volts, 3-phase. Small transformer on wall provides 115 volts for fan motor and control relays.

Primary-voltage distribution for . . .

Floodlighting a Baseball Field

Overhead primary distribution to tower-mounted transformers supplies a high-intensity floodlighting installation at a Houston, Texas, high school. Here's a fully detailed study of design and construction. The electrical installation was made by Dickey Electric Company.

By Weldon W. Henderson, *Electrical Engineer, Jochen & Henderson, Consulting Engineers, Houston, Texas.*

MODERN, efficient circuits make possible floodlighting of a baseball field at Spring Branch Senior High School, Houston, Texas. Here, primary distribution carries power overhead to transformers mounted on steel towers, with secondary feed to arrays of floodlight luminaires at the tops of the towers. A wealth of interesting detail —both design and construction—is involved in this project.

Design of the floodlighting system was, naturally, greatly influenced by the anticipated use to be made of the ball field. First, the floodlighting system had to be a high quality installation to withstand very frequent use. In this area of the country, baseball is almost always played at night. And this field would be used not only by the high school team, but also by many other baseball teams of the various leagues in the school district—Little League, American Legion, etc. And the lighting was not to serve simply as auxiliary lighting for late innings at dusk. It had to provide continuous-duty, high-intensity lighting for long use during full darkness. As a result of the heavy-duty needs of this ball field, economy itself demanded concentration on ruggedness and reliability in the equipment and quantity and quality of lighting on the field.

Correlating such factors as area of the playing field, need for uniform intensity and required lumens of light, basic design was resolved to a layout of eight clusters of tower-mounted luminaires—a total of 168 luminaires. This was also based on the use of both narrow-beam and wide-beam floodlights carefully aimed to blanket the field with a uniform intensity of 40 foot-candles. Incandescent floodlighting was selected for its economy and suitability to the design need for a large number of units to achieve uniformity of lighting level.

The luminaires selected are general-purpose enclosed sports-field floodlights with spun aluminum reflectors—for narrow beam pattern or wide beam pattern, as indicated on accompanying aiming plans, Fig. 1. The rear reflector and lamp receptacle housing on each luminaire is readily separated by spring latches from the mounting bracket and front reflector assembly, for quick relamping without need for tools. A gasket is used to make the unit completely raintight. The heat-resistant, impact-resisting glass cover is spun-sealed on the front re-

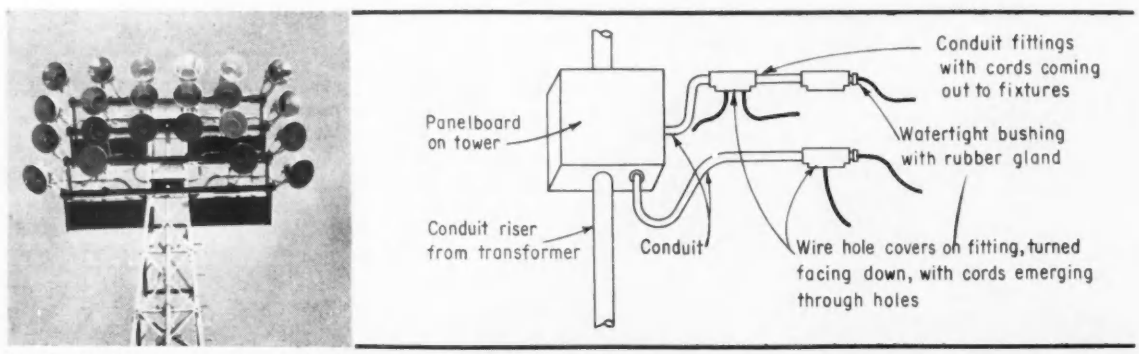

Conduit fittings with cords coming out to fixtures
Panelboard on tower
Watertight bushing with rubber gland
Conduit riser from transformer
Conduit
Wire hole covers on fitting, turned facing down, with cords emerging through holes

FIG. 3—Cord connection of each floodlight is made through a wire hole cover of a conduit fitting, facing down and pitched to avoid water entry, with watertight assembly of the components.

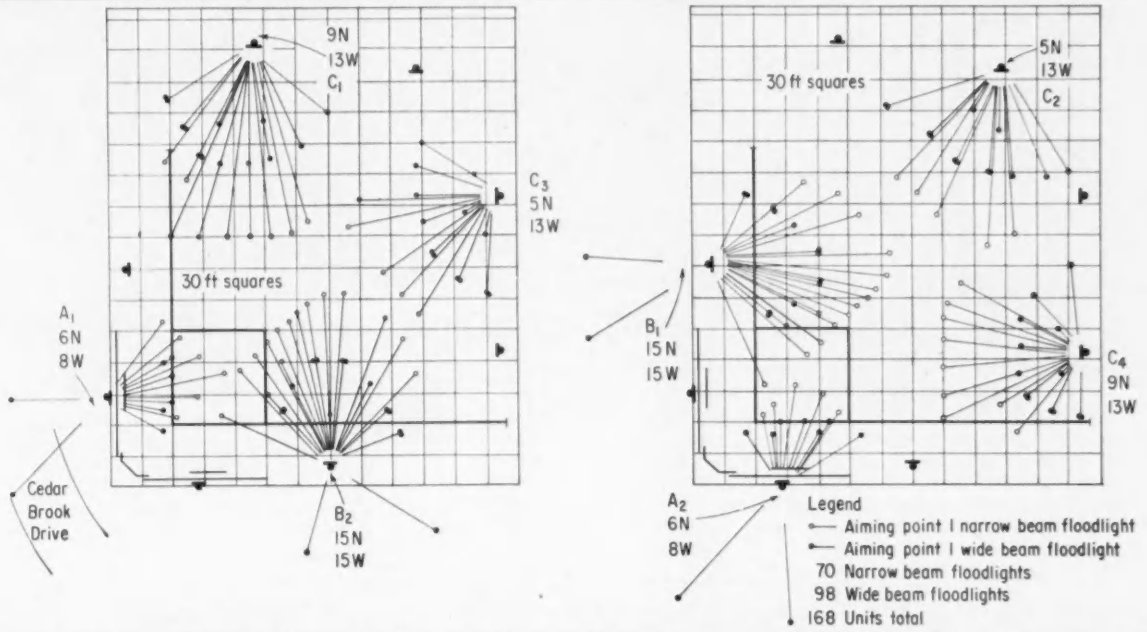


FIG. 1—Aiming plans show the point on the field to which each floodlight is aimed. It was a requirement of the job specs that the "manufacturer of the fixtures to be installed shall furnish an aiming diagram for the combination of fixtures to be installed." From their mounted position on the towers, fixtures were aimed at these spots by means of the aiming notch on each fixture mounting bracket. Note the eight fixtures aimed away from the playing field to provide low-level lighting for the spectator area and the approaches to the field. These eight units and four others which face the playing field are circuited separately from panels fed from a 15-kva transformer which is switched by a manual oil switch.

flector assembly. The mounting bracket on each fixture is a steel trunnion type for attaching to steel angle-iron cross pieces on the tower assembly, including a built-in wrench for positioning. This bracket incorporates horizontal and vertical degree scales for rough aiming of the fixture, with an automatic repositioning stop to reset the fixture at its aiming point. A built-in notch provides for accurate aiming of the fixture at a point marked on the playing field. Each fixture is equipped with a PS-52, 1500-watt clear incandescent lamp, rated at 105 volts to provide full output even at the low side of any voltage variation at the lamp socket.

An array of floodlights is set at the top of each of the eight towers used to light the playing field, Fig. 2. The fixture group on each tower is supplied from panelboards mounted at the top of the tower. Each luminaire is fed from one 30-amp, quick-make, quick-break circuit breaker in a panel. Each panel has 120/240-volt, 3-wire, single-phase bussing with main lugs for connection of the feed to the panel. Panel enclosures are raintight and weather resistant. Connection from each luminaire to a panel CB is made in conduit as shown in Fig. 3. Circuits come out of panel in conduit, then turn down and out of conduit through tee fittings with watertight covers with holes for the cords. The fitting is installed with the cover facing down. The cord for each luminaire is then looped over to the terminal compartment on the fixture.

Each lighting panel on a tower is fed by a set of TW conductors run up the tower in conduit. Where two panels are used for the main field lighting on a tower, the panels are tapped from one set of riser conductors. These conductors originate from the secondary of a 7200/120-240-volt single-phase transformer on a platform half way up the tower. These transformers are sized and located as shown in the basic distribution diagram, Fig. 4. Each transformer is a completely self-protecting unit, incorporating built-in lightning protection and thermal overcurrent protection. Each is class B-2, with cover-mounted high-voltage bushings and with four 2½% full-capacity-below-normal voltage-taps.

Although the electrical specifications listed tapered steel poles as the first mounting method for the

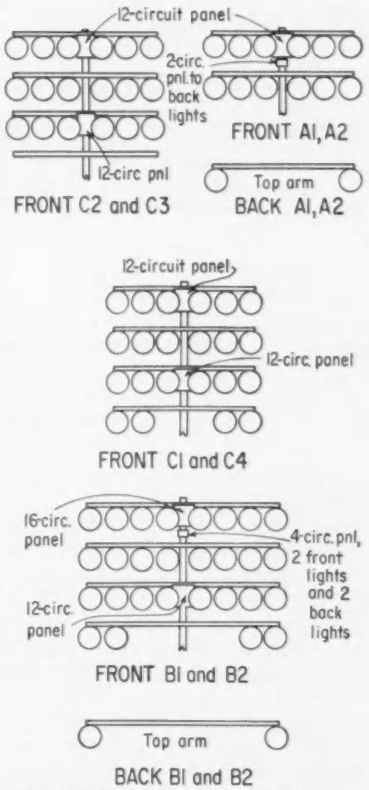


FIG. 2—Floodlight clusters and panelboards are mounted on the towers as shown here.

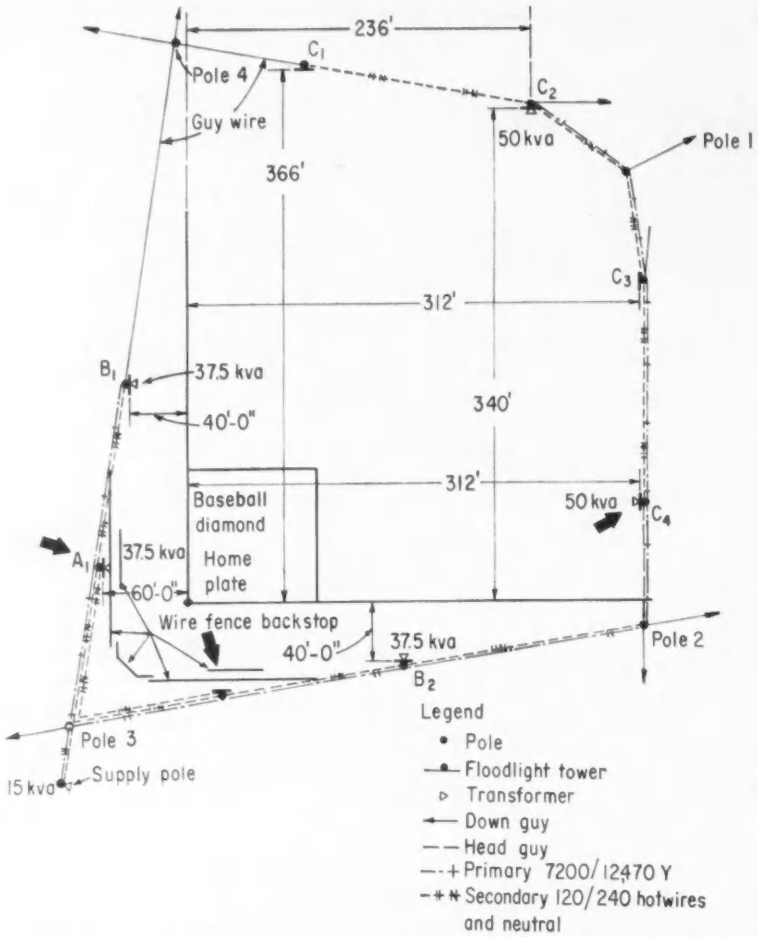


FIG. 4—Distribution layout shows primary and secondary overhead circuits from the main supply pole to the various steel towers of the system—towers with and without transformers, as indicated. Three towers are shown in accompanying photos which are identified to correspond to the numbers on the plan. Angles of photos are also indicated by arrowheads.

TOWER A-1 is fed from right in photo. Top conductor is phase A of primary, supplying this tower and continuing on to left to supply tower B-1. Primary of transformer on tower here is fed by tap to primary phase A and the common grounded neutral for primary and secondary circuits. The common neutral is the heavy conductor just below the primary phase. The transformer secondary supplies 12 floodlights at the top of the tower and the 3-wire secondary is also run back to the right to feed 12 floodunits on tower A-2 (which does not have its own transformer). This secondary run to A-2 consists of the two bottom conductors (the hot legs) in the group of five plus the common neutral. The other two conductors coming into this tower from the right (the third and fourth up from the bottom) combine with the common neutral to make up the 3-wire, 120/240-volt circuit, from the 15-kva transformer on the main supply pole. This circuit, which is controlled by the manual primary switch ahead of the 15-kva transformer, feeds two A-1 floods facing spectator area and four floods on B-1.

floodlights, two alternate methods—steel towers and wood poles—were also presented. Steel towers were selected at about a $3,000 saving over use of steel poles. The price differential between the towers and the less expensive wood poles was not great enough to warrant sacrificing the strength and durability of the steel towers.

Each tower is a four-post structure of galvanized angle steel. Each is designed to support the numbers of 20-in. floodlights shown in Fig. 4 and is capable of withstanding a 100 mph wind. Reinforced concrete foundations are used for the steel towers.

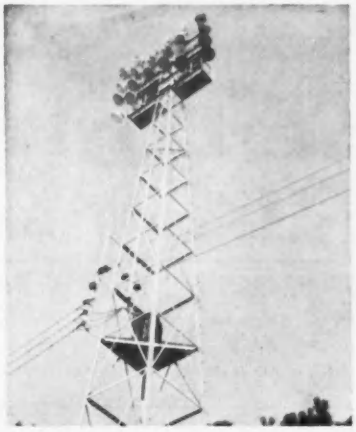
Electrical power distribution is made as shown in Fig. 5. Primary 3-phase, 4-wire, grounded supply at 12,470Y/7200 volts is made from a utility pole line to a wood pole adjacent to the ball field. Complete control of the lighting system is exercised through the use of oil switches mounted on a crossarm on the service pole and connected for ON-OFF control of the incoming primary lines.

One manually operated, single-pole oil switch controls phase B of the supply and feeds a single-phase 7200/120-240-volt, 15-kva transformer on the wood service pole for a total of 12 lights—four facing the field and eight covering the grandstand area along the baselines—for low-level lighting when the entire floodlight system is not turned on. This switch is manually operated from the bottom of the pole by a ½-in. galvanized pipe operating rod run up the pole to the switch.

Three single-pole oil switches—one in each of the three supply phases — are electrically operated units with 120-volt operating coils tapped from the secondary of the 15-kva transformer on the pole. As a result, these electrically operated switches can only be controlled when the manual oil switch feeding the transformer is closed. The 120-volt coil circuits are run in conduit from terminal boxes on the switches to a 30-amp fused switch at the lower end of the pole. Padlocks are provided for safeguarding the switch and the manual operator from unauthorized use.

Each of the primary oil switches is rated for 14.4 kv. The single manual switch is operated by a handle protruding from the housing and connected to the operating rod running to the bottom of the pole. Electrical operation of each of the other three units is provided by a 120-volt motor-operator which is remotely controlled from the bottom of the pole.

TOWER A-2 is supplied from the right in photo. The seven conductors coming in at right are (from top to bottom): primary phase B; primary phase C; grounded neutral common to primary and secondary; one secondary hot leg from 15-kva transformer for two floods on A-2 and four floods on B-2; the other hot leg for secondary circuit to the low-level floods on A-2 and B-2; one secondary leg from the transformer on A-1, supplying the 12 floods on A-2 facing the field; and the other hot leg from A-1 transformer, for the main floods on A-2.



TOWER C-4 is fed from right of photo. Three conductors coming in at right are (top to bottom): primary phase B; primary phase C; and the common neutral. The transformer on this tower is fed by phase B and neutral. From the secondary, conductors are carried in conduit up to the floodlight panel at top of tower and another set of secondary conductors (the bottom three conductors at left) is run to the left to serve the lighting panel on tower C-3. The top conductor running out at the left is primary phase C which is run to supply towers C-2 and C-1.

PRIMARY SUPPLY for entire electrical system is brought into this wood pole behind home plate. The two oil switches at left and the one far right on the crossarm are electrically operated from switch at bottom of pole to provide ON-OFF control of the three primary phases for the bulk of the field-lighting floodlamps. The other oil switch—the second from right—is manually operated by a rod handle run to bottom of pole and switches one primary phase to energize a 15-kva transformer on this pole. The transformer provides power for the motor-operators.

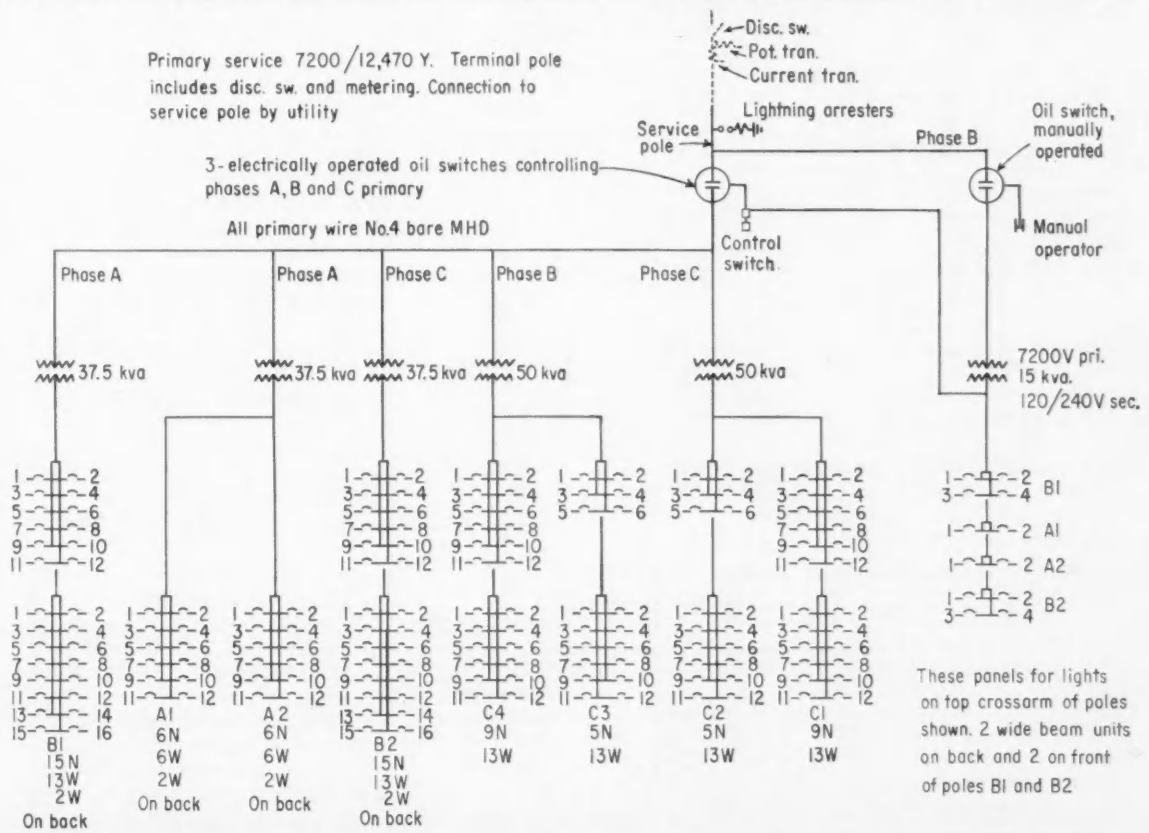

Primary service 7200/12,470 Y. Terminal pole includes disc. sw. and metering. Connection to service pole by utility
Disc. sw.
Pot. tran.
Current tran.
Lightning arresters
Service pole
Phase B
Oil switch, manually operated
3-electrically operated oil switches controlling phases A, B and C primary
Manual operator
All primary wire No.4 bare MHD
Control switch
Phase A
Phase A
Phase C
Phase B
Phase C
37.5 kva
37.5 kva
37.5 kva
50 kva
50 kva
7200V pri. 15 kva. 120/240V sec.
B1 15N 13W 2W On back
A1 6N 6W 2W On back
A2 6N 6W 2W On back
B2 15N 13W 2W On back
C4 9N 13W
C3 5N 13W
C2 5N 13W
C1 9N 13W
B1
A1
A2
B2
These panels for lights on top crossarm of poles shown. 2 wide beam units on back and 2 on front of poles B1 and B2

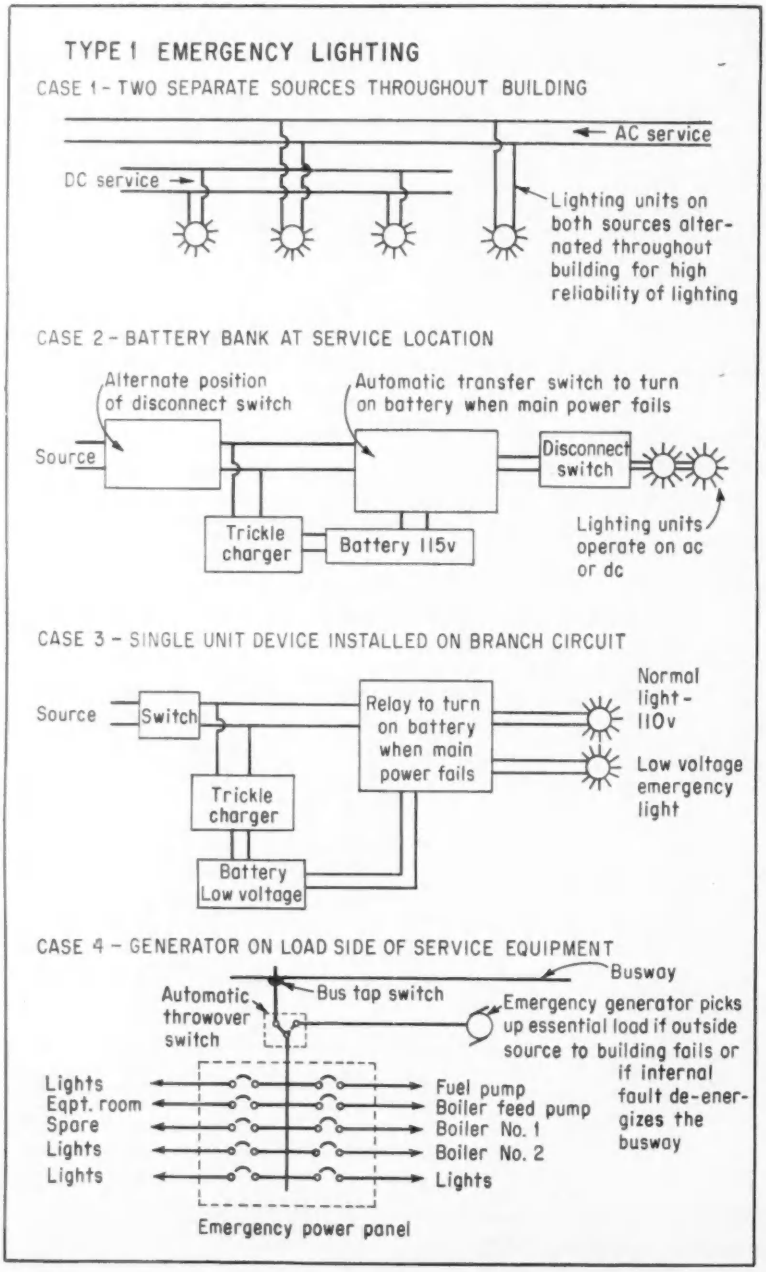
FIG. 5—Electrical distribution scheme for the complete floodlighting system.

About emergency power—

When the Lights Fail

A discussion of emergency electric power for safety in modern buildings, covering basic requirements of the NFPA Building Exits Code.

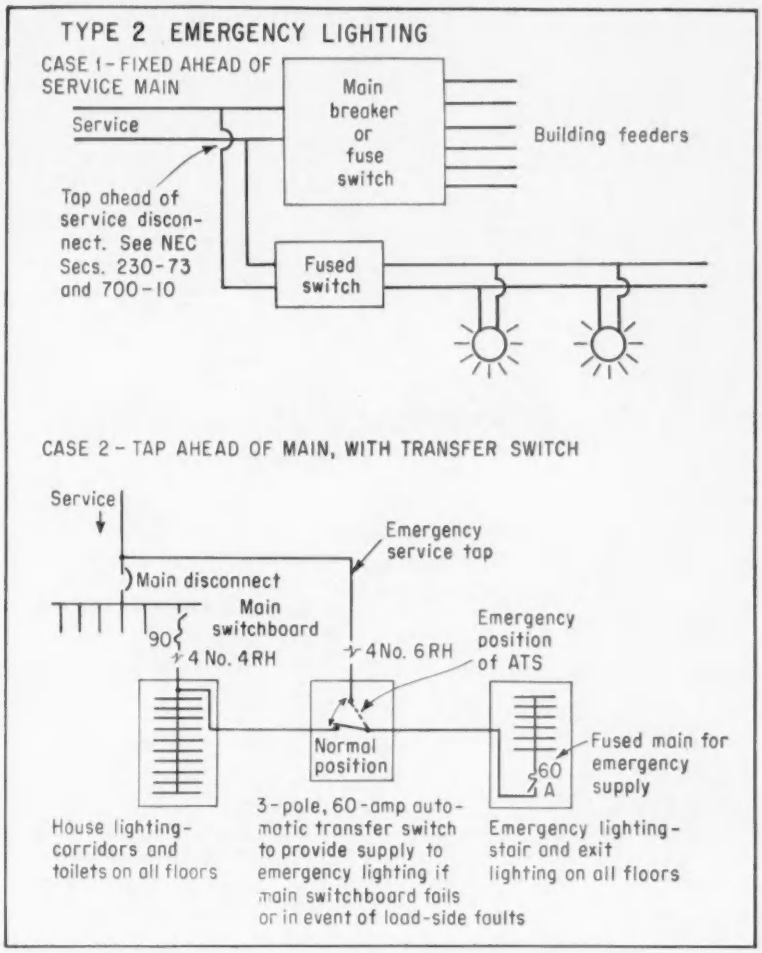
By Robert S. Moulton, *Consulting Fire Protection Engineer, Boston, Mass.*

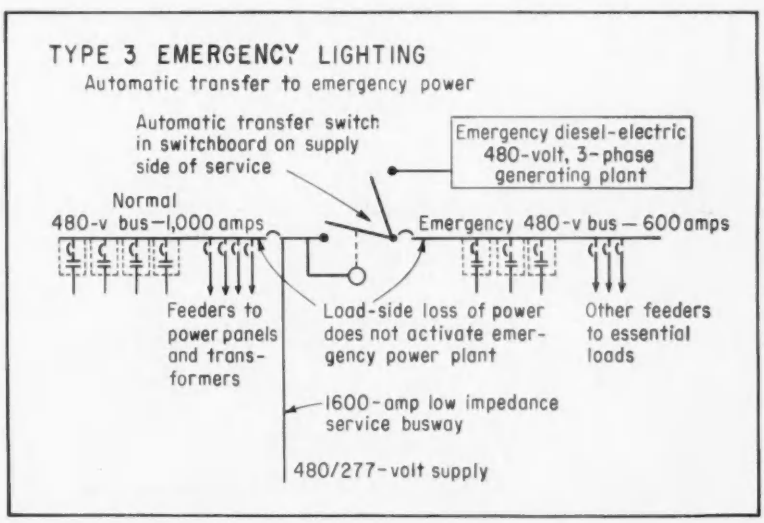

TYPE 1 EMERGENCY LIGHTING
CASE 1 - TWO SEPARATE SOURCES THROUGHOUT BUILDING
AC service
DC service
Lighting units on both sources alternated throughout building for high reliability of lighting
CASE 2 - BATTERY BANK AT SERVICE LOCATION
Alternate position of disconnect switch
Automatic transfer switch to turn on battery when main power fails
Source
Disconnect switch
Trickle charger
Battery 115v
Lighting units operate on ac or dc
CASE 3 - SINGLE UNIT DEVICE INSTALLED ON BRANCH CIRCUIT
Source
Switch
Relay to turn on battery when main power fails
Normal light - 110v
Low voltage emergency light
Trickle charger
Battery Low voltage
CASE 4 - GENERATOR ON LOAD SIDE OF SERVICE EQUIPMENT
Busway
Automatic throwover switch
Bus tap switch
Emergency generator picks up essential load if outside source to building fails or if internal fault de-energizes the busway
Lights
Eqpt. room
Spare
Lights
Lights
Fuel pump
Boiler feed pump
Boiler No. 1
Boiler No. 2
Lights
Emergency power panel

GROPING in the dark on the 20th floor of a New York hotel building during the "black-out" last June, my thoughts went immediately to the subject of emergency lighting. Where were the stairs, where were the emergency lights—what were New York's requirements—did they observe the provisions of the Building Exits Code, the NFPA standard which deals with all phases of exit safety including, of course, lighting of exits?

In this case there was no fire, no panic and, most fortunately, no loss of life. In this particular hotel the only illumination was an occasional flashlight and many matches which in themselves, lighted indiscriminately in all the locations, created something of a fire hazard. The Building Exits Code recognizes that there is need for emergency lighting not only in case of fire but for other emergencies and gives detailed requirements as to how such emergency illumination should be provided, such as by specifying different power sources so that in the event of failure of the principal source of power some light will remain.

The electric utility people are prone to minimize the hazard. They cite the record and show how relatively few cases there are of power failure. They are quite right—the cases of power failure are indeed few, despite the fact that there was a power failure in San Francisco on the same day as the one mentioned above in New York, and that there was another power failure in New York a couple of years previously. The point is that the utility people should not expect that they can produce 100% reliability in service. There are too many things beyond their control which can happen—storms, earthquakes, floods, acci-


TYPE 2 EMERGENCY LIGHTING
CASE 1 - FIXED AHEAD OF SERVICE MAIN
Service
Main breaker or fuse switch
Building feeders
Tap ahead of service disconnect. See NEC Secs. 230-73 and 700-10
Fused switch
CASE 2 - TAP AHEAD OF MAIN, WITH TRANSFER SWITCH
Service
Emergency service tap
Main disconnect
Main switchboard
90
4 No. 4 RH
4 No. 6 RH
Emergency position of ATS
Normal position
60 A
Fused main for emergency supply
House lighting - corridors and toilets on all floors
3-pole, 60-amp automatic transfer switch to provide supply to emergency lighting if main switchboard fails or in event of load-side faults
Emergency lighting - stair and exit lighting on all floors


TYPE 3 EMERGENCY LIGHTING
Automatic transfer to emergency power
Automatic transfer switch in switchboard on supply side of service
Emergency diesel-electric 480-volt, 3-phase generating plant
Normal 480-v bus—1,000 amps
Emergency 480-v bus — 600 amps
Feeders to power panels and transformers
Load-side loss of power does not activate emergency power plant
Other feeders to essential loads
1600-amp low impedance service busway
480/277-volt supply

dents or sabotage to distribution systems or equipment, in addition to the ever-present danger of fire which, of course, generally affects only a single building.

The utility efforts to maintain continuity of service are indeed to be commended and are increasingly effective in approaching 100%. However, it is practically impossible to reach 100% safety; and the fact that there is need for emergency illumination should not be construed as any criticism of the utility efforts but rather an extra precaution which is needed when service fails, despite all reasonable precautions on the part of the utility.

Returning to my office in Boston after the "black-out" in New York I was naturally curious about the emergency lights in my own office building. These are battery-powered lights with a trickle charger plugged into outlets in convenient locations in the corridors, and designed for automatic operation in case of power failure. The device in the corridor on our floor was unplugged, and nothing happened when I pressed the button. This, of course, is in violation of Article 700 of the National Electrical Code which, although it does not itself require emergency power in buildings, does specify how emergency illumination is to be provided. The Code specifies permanent connection and prohibits any plugged-in devices. (Sec. 700-22).

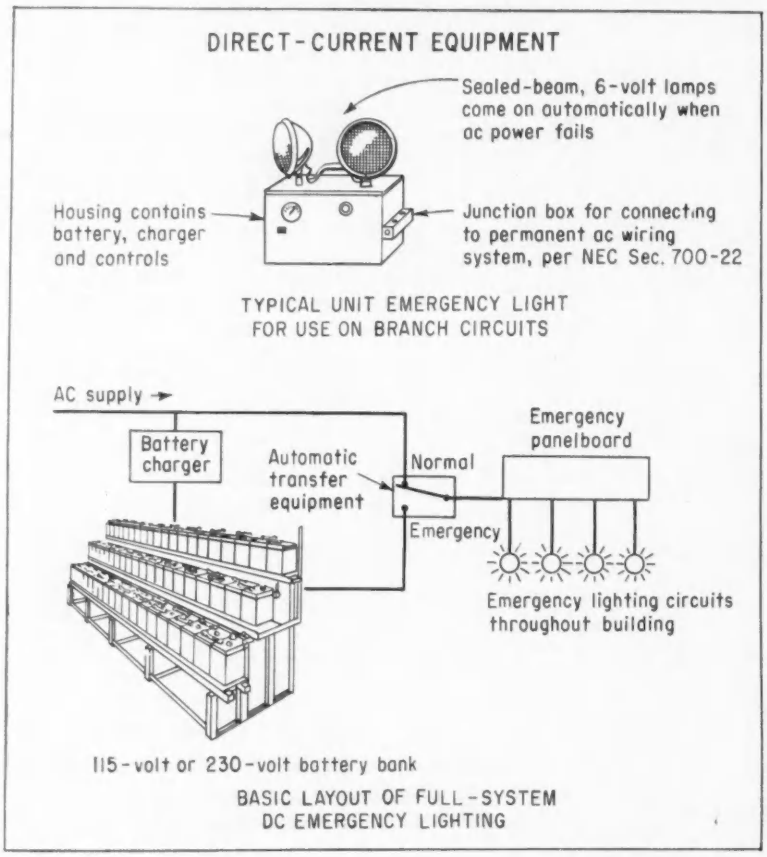
The emergency systems in Boston were largely installed as a result of legislation following the Cocoanut Grove fire. They worked well for some time and in a case of power failure in Boston a few years ago the emergency lights generally functioned and provided good illumination. What would happen now, however, is another question because a good part of this equipment simply has not been maintained.

There are two standards of the National Fire Protection Association which deal with emergency lighting: the National Electrical Code, which tells you how it should be provided; and the Building Exits Code which specifies where emergency lighting is needed. The "where" is not simple, because there are different grades of emergency lighting recommended for different situations. There are also many situations, particularly where only a relatively small number of people may be present, where the Building Exits Code does not require anything more than normal (not emergency) lighting, on the ground that the degree of hazard to life is not sufficient to justify requiring emergency lights.

There is a further standard of the NFPA which covers emergency electrical systems in hospitals. This, however, is outside the scope of the present article.

The Building Exits Code specifies three classes of emergency lighting:

Type 1. Operates automatically


DIRECT-CURRENT EQUIPMENT
Sealed-beam, 6-volt lamps come on automatically when ac power fails
Housing contains battery, charger and controls
Junction box for connecting to permanent ac wiring system, per NEC Sec. 700-22
TYPICAL UNIT EMERGENCY LIGHT FOR USE ON BRANCH CIRCUITS
AC supply
Battery charger
Automatic transfer equipment
Normal
Emergency
Emergency panelboard
Emergency lighting circuits throughout building
115-volt or 230-volt battery bank
BASIC LAYOUT OF FULL-SYSTEM DC EMERGENCY LIGHTING

in case of failure either of the outside source or of the lights within the building due to fire or inside electrical failure.

Type 2. Operates automatically to provide illumination in case of fire or electrical failure within the building, but will not function in case of outside power failure.

Type 3. Operates automatically to provide illumination in case of outside power failure, but will not function in case of fire or inside electrical failure.

The accompanying drawings illustrate schematically several ways of accomplishing Type 1 and Type 2 emergency lighting. There are also other possible ways of producing the desired results. The National Electrical Code and the Building Exits Code should be referred to for full details. Type 3 systems are not often used, because only a little more is needed to make a Type 3 system qualify as Type 1, covering both inside and outside electrical failure.

The provisions of the Building Exits Code on the types of emergency lights in various occupancy groups are summarized in the table at bottom of this page.

There has been a good deal of confusion about emergency lighting, because there are two distinct kinds of situations covered. One, a general power failure in an entire area and the other, a failure of the lights in an individual building due to electrical fault or fire. Failure due to fire is most serious, because this means no light to find exits when they are most needed, and because darkness adds greatly to the possibility of panic. However, any failure of lighting is potentially dangerous, and the degree of danger depends upon the number of people exposed. It would be fine to have all lights so arranged as to be 100% safe against any failure, but this would be prohibitively expensive. One must be reasonable, and this is the basis of the Building Exits

(Continued on page 120)

Summary of Emergency Lighting Requirements in the Building Exits Code, NFPA No. 101

(In all situations where buildings are subject to night occupancy, the Building Exits Code requires exit illumination from normal lighting sources.)

Assembly Occupancy	
1,000 or greater occupancy	Type 1
200 to 1,000 occupancy	Type 2 or 3
Buildings of less than 1,000 occupancy, used exclusively for religious purposes, exempted	
Under 200 occupancy, normal exit lighting	
Educational Occupancy	
Buildings designed for night use	Type 1 or 2
Institutional Occupancy	
Hospitals, new	Type 1
Applies only to auditoriums, assembly rooms, large wards, stairways and exitways	
Hospitals, existing	Type 1
Nursing homes	Type 1 or 2
Nursing homes, existing with patient capacity of 30 or more	Type 1, 2 or 3
Nurseries, normal lighting only	
Prisons	Type 1
Residential Occupancies	
Hotels over 500 rooms	Type 1
25-500 rooms	Type 2
Exception: Where each room has direct exit to outside, as in motels, no exit lighting required.	
Apartments, more than 25 living units	Type 1 or 2
Dormitories for more than 100 persons	Type 1 or 2
Other residential, normal lighting	
Mercantile Occupancies	
30,000 sq ft aggregate gross area or having more than 3 floor levels used for sales purposes	Type 1, 2 or 3
3,000-30,000 sq ft utilizing any floor above or below street level	Type 1 or 2
Other stores, normal lighting	
Office Occupancies	
Occupied by 1,000 or more persons	Type 1, 2 or 3
Other office, normal lighting	
Industrial Occupancy, normal lighting	
Storage and Miscellaneous, normal lighting	

ARROW·HART

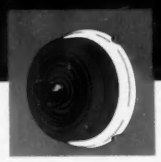
BIG* SWITCH

from this in 1890

*A big switch, indeed, in our history is the one pictured here: the first wall switch manufactured by Arrow-Hart. Installed in the old Coates House at Kansas City in 1890, this switch was practically as good as new and still operating dependably when the hotel was remodeled in 1926!

ARROW·HART

...to this in 1962



Standing in sharp contrast to our simple 1890 wall switch is this large 1962 Arrow-Hart Control Center. Combining Arrow-Hart contactors, starters, relays, and pilot devices with other electrical controls in a single unit, this center is a big-shouldered symbol of Arrow-Hart's growth in size and product scope.

MOTOR CONTROLS

Ranging from miniature relays to huge control centers, these controls combine greatly reduced size and weight with improved electrical performance and reliability. Contractors and maintenance men appreciate the easy installation. Designers and manufacturers of machines and equipment appreciate Arrow-Hart compactness, because it helps pack more electrical control capacity into less space. Representative units from the comprehensive Arrow-Hart lines of motor controls and auxiliary equipment are shown at the right.

WIRING DEVICES

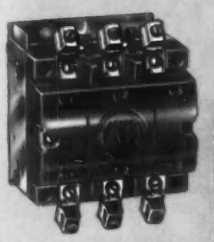
A pioneer in the development of wiring devices, Arrow-Hart manufactures complete lines of wiring devices for virtually any industrial, commercial, institutional and residential requirement. Respected for highest quality construction, Arrow-Hart Wiring Devices incorporate many exclusive improvements in design and construction that contribute significantly to performance and safety. The units shown here represent a sampling from the extensive Arrow-Hart lines.

ENCLOSED SWITCHES

This equipment includes Safety Switches ranging from 30 to 1200 amperes. All 30 to 200 ampere Switches are completely new in both the heavy-duty and light-duty lines. These switches cover a broad variety of commercial and industrial applications. Also available are new lines of 100 and 200 ampere "Add-On" Fusible Service Equipment for residential and commercial usage. Exclusive new "Add-On" feature provides exceptional versatility. A few representative examples of this product line are illustrated at right.

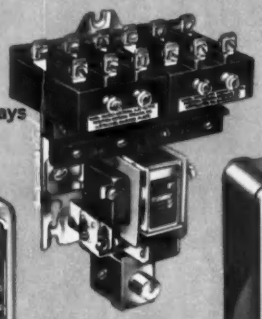
SPECIALTY SWITCHES

These switch lines, which include more than 100,000 different items, represent the application of "human engineering" principles to electrical switches for use on tools, appliances, electronic gear, missile ground support units and many other types of electrically operated equipment. The results are an almost infinite variety of switches—each of which provides safe, convenient operation for the user. A selection of switches from this line is shown at right.



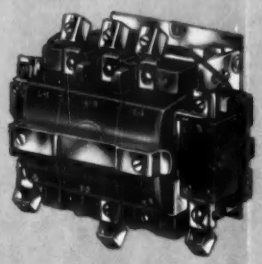
"CRA" Magnetic Contactors NEMA Sizes 00-5

Heavy Duty Relays

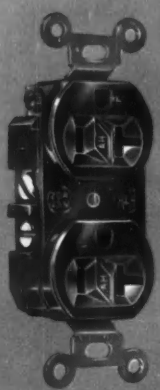


Manual Starters

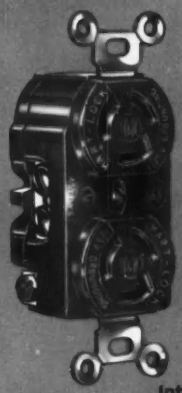
Push Buttons

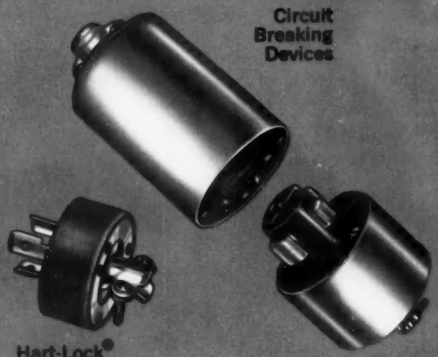


"RA" Magnetic Starters NEMA Sizes 00-5



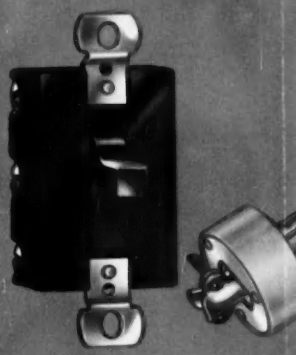
2-Wire/3-Wire Grounding Devices





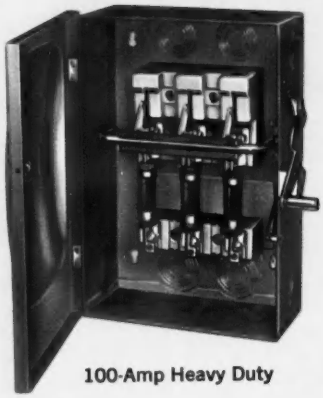
Hart-Lock® Interlocking Devices

PowerLock® Circuit Breaking Devices



3-Position Switches

30-Amp Light Duty



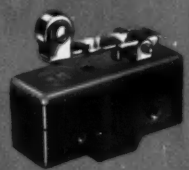
100-Amp Heavy Duty

100-Amp Light Duty

Military Specification Switches

Midget Toggle Switches

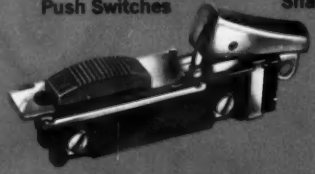
Midget Push Switches



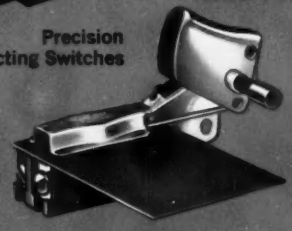
Precision Snap-Acting Switches

Overload Protective Switches

Midget Slide Switches



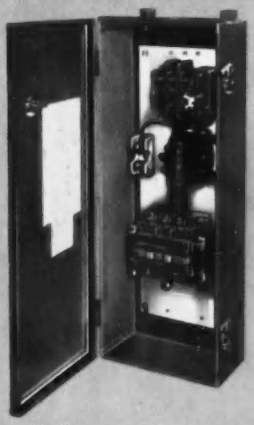
Reversing Tandem Switches



Heavy-Duty Portable Tool Handle Switches

Combination
Starters
NEMA Sizes 0-5

Reversing
Drum Switches



Reduced Voltage Starters
NEMA Sizes 1-5

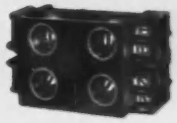
Yellow
Neoprene Caps
and Connectors

Quiette Switches

4-Wire Grounding Devices

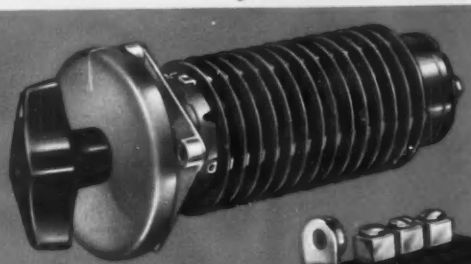
Corbin
Lock Switches

100 and 200 AMP "ADD-ON" FUSIBLE SERVICE EQUIPMENT

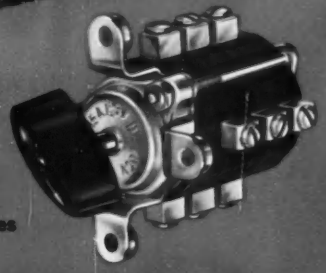


"Add-On"
Components

Midget
Toggle
Switches



"JR" Rotary Switches



Rotary
Packet
Switches

ARRO

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Electrical

Equipment

Hart offers you a unique combination of

our Comprehensive Product Lines

de range of electrical equipment needs.

e opportunity to reduce inventories and

y purchasing your electrical equipment

, convenient source. Equally important,

u can rely upon Arrow-Hart products for

e quality, performance and service life!

ARROW-HART QUALITY

THEN . . .

Back in 1890, the first Arrow-Hart switches were built from fine materials by conscientious craftsmen, who took pride in their workmanship and in their attention to detail. It is not surprising, therefore, that many of these switches delivered a half-century or more of dependable service.

. . . AND NOW

Today, fine materials and conscientious craftsmanship are still the basis of Arrow-Hart quality . . . and modern industrial science has given us many additional tools. Taking full advantage of the best that the old traditions **and** the new sciences have to offer, Arrow-Hart has achieved uniformly high standards that are your assurance of reliability and quality.

. . . PLUS PROMPT SERVICE AND AVAILABILITY

Meeting your electrical needs takes more than quality products. Equally important are prompt service and availability. For this reason, Arrow-Hart products are made available to you through Authorized Arrow-Hart Distributors conveniently located in principal cities throughout the country. There's one in **your** area . . . organized and equipped to serve you and located as near as your telephone. And to provide efficient back-up service for its Distributors, Arrow-Hart also maintains a nationwide network of Branch Offices and Warehouses. As a result, you can count on Arrow-Hart and your local Arrow-Hart Distributor to make available the service and the equipment you need . . . WHEN YOU NEED IT!

INFORMATION ON ALL ARROW-HART PRODUCT LINES . . .

can be obtained from your local Arrow-Hart Distributor—or you can obtain fully descriptive, illustrated product literature by writing direct to The Arrow-Hart & Hegeman Electric Company, 103 Hawthorn Street, Hartford 6, Connecticut.
Send today for your free copies of any or all of the following: Wiring Device and Enclosed Switch Catalog No. WD-29, Motor Control Catalog No. 15, and Specialty Switch Catalog No. Z-12.

MOTOR CONTROLS
WIRING DEVICES
ENCLOSED SWITCHES
SPECIALTY SWITCHES

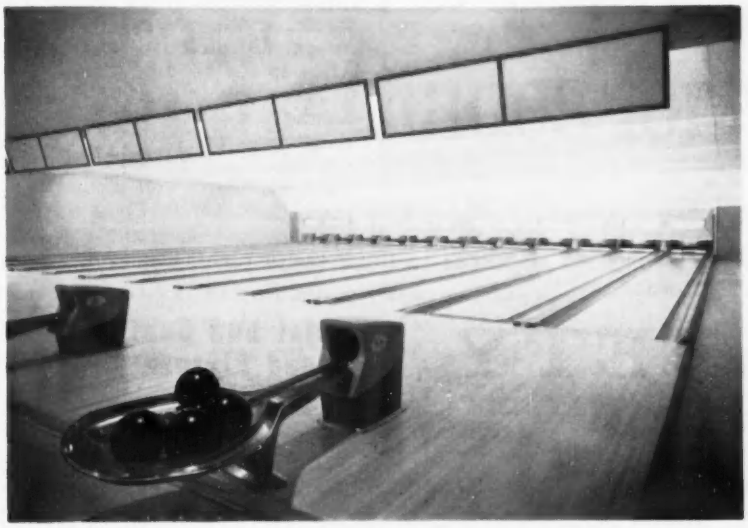
AH

QUALITY SINCE 1890

ARROW·HART

The Arrow-Hart & Hegeman Electric Company, Hartford 6, Connecticut

MAKE THE BIG SWITCH TO ARROW-HART!



GOOD LIGHTING is provided in this modern bowling center by continuous rows of fluorescent lamps placed behind lips of acoustically tiled sawtooth ceiling baffles. Electric facilities in building range from heating and air conditioning to cooking, hot water heating, pin spotting and subway ball returns.

Electric Heat Wins Approval at Northwest Bowling Center

Shelley, Idaho, is a remote rural town boasting a population of 2600 and admitting to winter temperatures of 25° "below." Yet, in this rather improbable setting, appreciative keglers can enjoy an up-to-the minute modern total-electric bowling center (Russet Lanes) where facilities include electric heating and air conditioning as well as electric cooking and water heating provisions.

Heating is a 2-medium consideration; resistance cables being installed on 3-in. centers beneath ceiling plaster in most areas, and electric baseboard units installed adjacent to seating sections. Heating is thermostatically controlled in 13 zones so that, regardless of local desires, temperatures can be equated to desirable heat levels.

Use of electric heating is unique (and perhaps questionable) in a section where temperatures are frequently sub-zero. However, since the building is adequately insulated and zoned, the owners claim that operation of the system is economically comparable to other forms of heating. As to the definition of "adequate" insulation, in this installation we mean 12 in. of asbestos flakes blown between ceiling joists, 6 in. in the north wall and 4 in. in walls on the other three sides. In addition, a 2-ft strip of insulation board was placed beneath the outer perimeter of the concrete base slab upon which the building rests; this procedure serving as a barrier between slab and adjacent frozen ground during winter months, and thereby reducing excessive heat losses.

As to the air conditioning counterpart, this bowling center has a modern "split system" installation, with three remote air-cooled condensing units on the roof, and with air distribution to interior sections through ceiling diffusers.

Integrated with this installation are two electronic air cleaners that remove smoke and dust from recirculated and fresh air supply ducts as well. Air likewise is cleaned by passage through a water curtain prior to circulation, a factor contributing to housekeeping economy since redecorating, sweeping of alleys and cleaning of lighting fixtures and walls is necessary only infrequently. Clean air also is appreciated by those normally addicted to hay fever. And, in summer months when ragweed thrives, the "lure of the lanes" is doubly attractive.

Snacktime finds business brisk in the lanes' modern kitchen where electric equipment includes griddles, toasters, deep fat fryers, a food warmer, ice making machine, refrigerators, coffee makers and the like. One also notices two 30-gal. electric hot water heaters; one installed adjacent to the kitchen and the other serving the wash rooms, with short pipe runs and automatic temperature controls to minimize heat losses. And, since electric heaters do not require flues, another factor presents itself in the economy picture.

As indicated by the accompanying photo, lighting over the lanes likewise is excellent, with glare completely deleted due to the location of continuous rows of fluorescent lamps placed behind a series of acoustically tiled cross-alley sawtooth ceiling baffles.

Of course, pin-setting equipment also is electric and automatic, as

ELECTRIC HEATING consists of radiant conductors stapled to sheetrock backing panels, then concealed by finishing plaster coating. Heating circuits are in 13 zones to permit desirable thermostatic regulation in various areas of activity, while operating voltage level is 220.

ELECTRICAL CONTRACTOR for complete installation was Scott Williams, Solar Electric Heat and Insulation Co., St. Anthony, Idaho, seen here as flake asbestos is blown between exterior studs and held in place by plastic membrane pending placement of sheetrock panels.

WE Pledge...

Margin for SAFETY

"Margin for SAFETY"

is the *extra* protection that Shawmut builds into its products for your benefit. You get *extra* value when you need it most. It's the *extra* that makes Shawmut circuit protection devices stand up when the showdown comes. It isn't a boast or an empty claim. It's quality above and beyond the standards set for the industry — built right into the product.

"Margin for SAFETY"

begins with integrity — integrity of character... integrity of engineering... integrity of materials ... integrity of craftsmen. It comes from trying to give more for the money — not less. It doesn't come from skimping, misrepresentation or deception. It comes from experience, know-how and leadership.

"Margin for SAFETY"

is part of all Shawmut circuit protection devices. It is your guarantee that you are getting more than you pay for. It is your assurance that Shawmut products are fairly represented. They not only meet industry standards, they exceed them. It means that all Shawmut products are engineered to the application for which they are intended.

When you want **"Margin for SAFETY"** look for the Diamond "S" and the Shawmut name on the fusible products which you buy. Only Shawmut can give you this "Margin for Safety."

THE **CHASE-SHAWMUT** CO.
374 MERRIMAC STREET • NEWBURYPORT, MASSACHUSETTS
Subsidiary of I-T-E CIRCUIT BREAKER CO

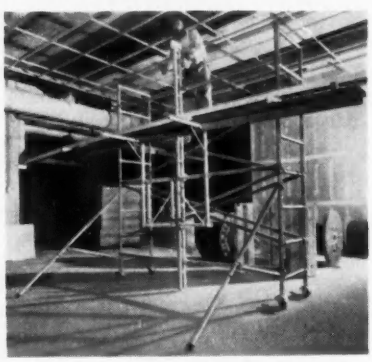
are the subway ball returns, foul lights and "split" indicators. And let us not overlook the P-A system for announcements and background music, or the intercom system between all direction and service areas in the building.

The all-electric installation was handled completely by Scott Williams, manager of the Solar Electric Heat and Insulation Co., St. Anthony, Idaho, and planned with the cooperation of Clyde Johnson, applications consultant for Utah Power & Light, Rexburg.

Hoist and Scaffold Speed Fixture Installation

Ace Electric Co., Portland, Ore., recently installed over 1000 8-ft 150-lb fluorescent lighting fixtures in a new Tektronix industrial plant, using an aluminum hoist assembly attached to a standard rolling scaffold for the purpose, and thereby reducing normal installation manhours by an estimated 50%. In this installation, mounting height of fixtures was 14 ft above the floor and, as noted in the accompanying photo, fixtures were floor-assembled and raised into position in multiple groups.

This hoisting rig consisted primarily of a manually operated winch which, in turn, elevated twin horizontal lifting arms along a vertical track. As noted, the arms support a 20-ft-long wooden platform, upon which the pre-assembled rows of fixtures were placed, then raised into their desired positions for convenient attachment and connection.



VERTICAL WINCH elevates twin lifting arms along central track attached to side of tubular light-weight easily-assembled aluminum scaffold. Arms in turn support long wooden platform holding pre-assemebled row of fluorescent fixtures which are raised into exact desired position for attachment to suspended ceiling framework.

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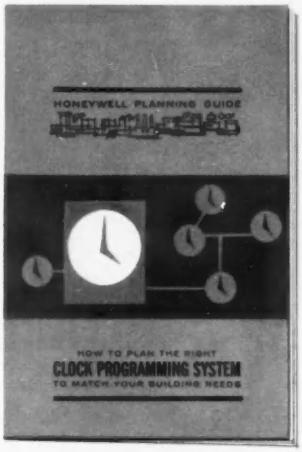
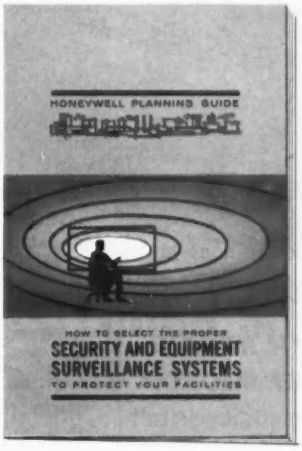
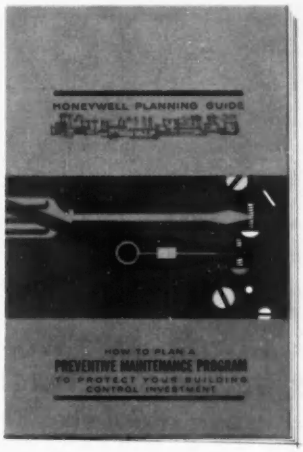


Gives complete facts on modern systems. Tells how clocks can ring bells, turn lights and other equipment on and off on schedule. Where systems can be used to increase efficiency in all types of buildings.

Tells why systems can save up to $25,000 or more yearly in industrial plants, how new electronic and sonic devices can inexpensively protect everything from a small area to an entire building.





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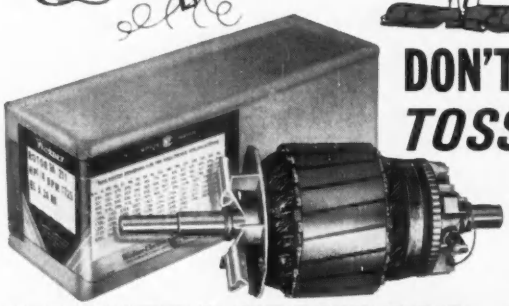

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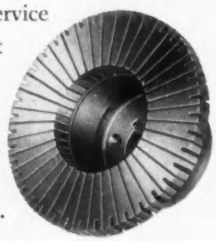
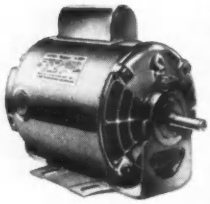
Rewinding small motor armatures takes valuable time and returns very little profit . . . so why bother with it? Use a Wagner® Standard Armature as a replacement and you not only give your customers fast service and complete satisfaction, but you keep your equipment open for larger, more profitable jobs. Armature replacement is easy . . . and there's no chance of making a mistake. Wagner K and M "specs", used with the label on the package, make certain you have the right armature every time . . . an armature that fits and works perfectly.



When you do rewind larger armatures, be sure you use genuine Wagner Replacement Commutators. Made to exacting specifications and designed to withstand tremendous centrifugal force . . . they last for years.



IF A MOTOR ISN'T WORTH REPAIRING, SELL A NEW WAGNER MOTOR

There are times when repairing a motor is not practical. You can assure your customer's satisfaction by selling him a new Wagner Motor as a replacement. You get full profit and provide over-the-counter service. Check with your Wagner distributor for full details and start cashing in on the sales of replacement motors now.

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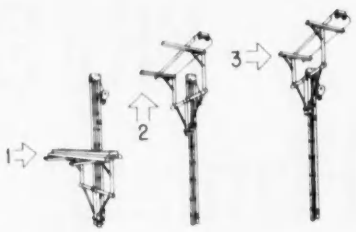

FIXTURES, busways or similar loads to be raised may be placed on lifting arms at convenient height above floor, as indicated by arrow 1. Winch then elevates arms along vertical track to desired height, arrow 2. Arms can then be shifted horizontally on rollers until fixtures are positioned in exact mounting position, arrow 3.

In similar previous installations, Ace Electric had required a 4-man crew, although two men were able to handle this assignment without difficulty in approximately the same length of time.

Beacon Marks South's Tallest Building

A new "star" in the southern sky is a revolving beacon atop the Bank of Georgia building in Atlanta, completed last year. It serves as a landmark on Atlanta's horizon, marking the South's tallest building located at famed Five Points in Atlanta, and as an aircraft beacon for the guidance of airline pilots.

The new Bank of Georgia building is 31 stories high, and is reportedly the tallest reinforced concrete structure in the U. S. The 36-in. revolving beacon is located 432-ft 3-in. above street level, and the tower and light is licensed by the Federal Aviation Agency. Its location for pilots of the skyways is latitude 33° 45 min. 15 sec. North; longitude 84° 23 min. 15 sec. West, as listed by FAA.

The 36-in. diameter landmark revolving beacon projects light in two directions simultaneously, 180 degrees apart. One light beam is white, the other is red. It rotates at a constant speed of six revolutions per minute. Its optical system consists of a lens combination in each end of the cast silicon aluminum housing, with a single lamp in the center. Each combination consists of an 18-in. inner doublet lens and a 36-in. diameter clear outer lens assembly. The outer lens assembly is made of a one-piece bulls-eye center lens 20-in. in diameter, with a surround of 12 two-piece 30° sectors. The red color is on one inner doublet lens.

THIS PURPLE LINING MEANS TWO-WAY SAVINGS

1. FASTER, EASIER PULLS: the purple lining means Kaiser KINGFISHER is the only conduit with K-40 silicone . . . the specially developed smooth, hard inner lining that lets cables slip past bends up to 61% easier!†

2. KAISER ALUMINUM'S EXTRAS: this exclusive purple lining also tells you that Kaiser KINGFISHER is the only conduit that saves time and money with: aluminum's light weight, easy threading, uniform bending, and high strength forged couplings.

Only competitively priced Kaiser KINGFISHER has all the advantages of aluminum plus slick K-40 silicone lining. Cut installation costs on your jobs: look for the purple lining and get two-way savings . . . from your authorized Kaiser KINGFISHER Distributor.

† Pull required after fourth bend in standard test comparing other lined and unlined conduits including steel: using 3 #2RHW cables in 1¼" conduit.

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The Heinemann Safelet is a compact unit that neatly combines circuit-breaker safety with plug-in convenience. It has hundreds of applications, can be used for the individual protection of power tools, fractional horsepower motors and almost all general appliances.

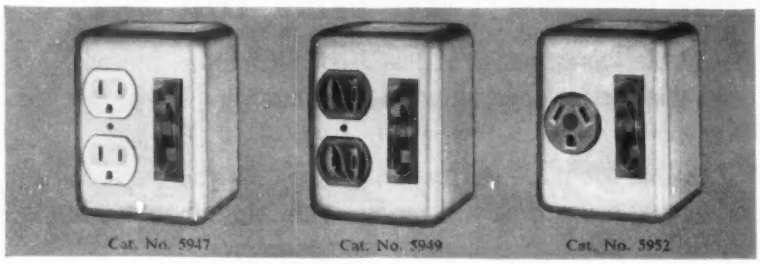
Now you can have the Safelet with any of a large number of receptacles, single and duplex, in twist-lock, polarized, "T" slot and other styles.

And now you can have a wide choice of circuit breaker ratings: from 6 to 50 amperes, at the most commonly used a-c and d-c voltages.

The Safelet enclosure is made of 16-gauge steel with an attractive grey hammertone finish. Units are available for either flush or surface mounting.

Of course, the circuit breakers used are Heinemann breakers . . . long accepted by the electrical industry as the standard of performance.

For full details, send for Bulletin 1000.



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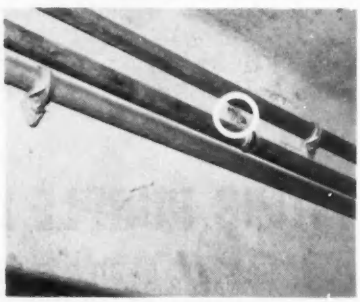
S.A. 1689

NEW "STAR" in the sky over Atlanta, Ga., is a 2,550,000 candlepower beam revolving 36-in. beacon, located atop and serving as a landmark for the new 31-story Bank of Georgia building.

The beacon contains two 1000-watt 30-volt mogul bipost base lamps, one of which serves as a spare. A magnetic lamp-changer automatically throws into focus and connects the spare lamp when the first lamp fails. When this happens, a lock-in relay closes and indicates by a red signal light that the first lamp has burned out. A 1000-watt 120/30-volt transmormer supplies 30-volt electric power to the lamp, and is an integral part of the beacon.

The white light beam is of 2,550,000 candlepower and both white and red light beams are elevated two degrees above the horizon. On a clear night the beacon can be seen from a distance of 25 miles.



DURING CONSTRUCTION of the New York State School for the Blind, Ebling Electric Co., Batavia, N. Y., used a hammer-actuated, piston-drive tool to mount switches, panels and conduit on walls and ceilings of pre-stressed concrete. Architects specified use of drive fastenings for mounting in concrete and steel. Ebling chose the Hilti tool, a hammer-actuated, piston-drive fastening tool because they felt that, in this case, it provided a safe and efficient method. Photo shows conduit supported by cast conduit straps; hammer-actuated, piston-drive fastening method was used to install the ¼-20, ¾-in. mounting studs.

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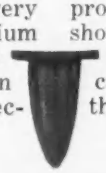

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EMERGENCY POWER WHEN THE LIGHTS FAIL

[FROM PAGE 106]

Code. This standard of the National Fire Protection Association, incidentally, is only advisory, but has been widely used as a guide to good practice as well as being adopted in law in many places.

There are various details to think about in the design of emergency lighting systems. Take, for example, an incident which occurred in a large church in a Boston suburb. Sometime after the Sunday service, the outside power failed. With the particular system installed there, the emergency lights came on automatically. But nobody was at the church, and the battery of the system continued to deliver power to the emergency lights. The duration of the outage was such that the expensive battery system was completely exhausted and ruined. The situation was not discovered until 24 hours later, at which time the emergency system was completely out of commission.

The foregoing occurred with the emergency system switch in the alternate position shown in the accompanying drawing for Type 1, Case 2 condition. With the switch in this position, it could not be turned off at any time, because the emergency lights would be automatically energized. The trouble in the church could have been averted by using a switch in the position at right, where the switch could have been turned off when the building was not in use. Then, if a power failure occurred, the batteries would come on but would have no load to drain them. The switch in position at right, therefore, permits effective use of emergency system.

The trouble in the church system could also have been averted if design of the system had observed Building Exits Code provisions, which require automatic shut-off of the battery supply after its designated period of operation. Such automatic shut-off saves the battery and preserves it for further emergency use.

The same comment applies to Type 1, Case 3, where, with the switch in the position shown, the automatic battery shut-off is the only available safeguard against depletion of the battery during times that the building is unoccupied. Of course, in a building such as a hotel or a transportation terminal—where the building is in operation continuously for 24 hours a day—the situation is different, and there is not much chance of the emergency system coming into play unnoticed. But with any building subject only to occasional or periodic use then (for example, a church or school, etc.), it is necessary to design the system so that some janitor's desire to save money by shutting off all lights during the inactive period will not jeopardize the emergency equipment. That is, the janitor must not be able to unwittingly energize the emergency system by opening a main or feeder disconnect.

Another detail is that the burning out of a single light bulb must not leave any area in total darkness. This is likely to occur with the single unit device, Type 1, Case 3, where there is only a single light bulb. These and other provisions necessary for reliable and satisfactory emergency lighting are spelled out in the National Electrical Code and the Building Exits Code.

The need for emergency lighting service should be obvious, but it seems to be recognized by the public only after some major disaster. The classic examples with the greatest loss of life were the Iroquois Theatre fire in Chicago, and the Cocoanut Grove Night Club fire in Boston. Lighting failure was an important factor in the loss of about 500 lives in each case.

HEADING A DELEGATION from New York City to the recent IAEI Eastern Section meeting in Philadelphia are (L-R) J. J. Taubenblatt, electrical contractor; R. A. McNeal, Consolidated-Edison Co.; and Felice Marcellino, chairman of the advisory board for the DWSG&E.

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FOR MORE COMPLETE INFORMATION, TURN PAGE ▶

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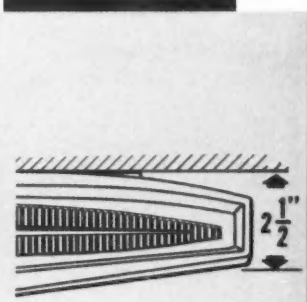
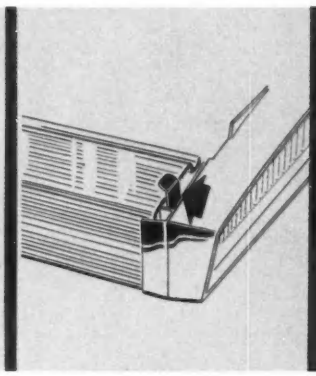
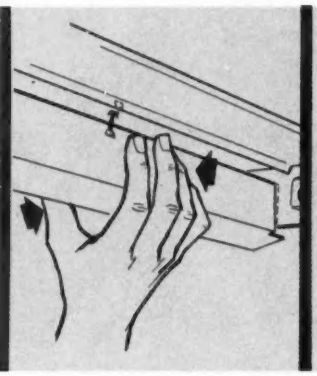


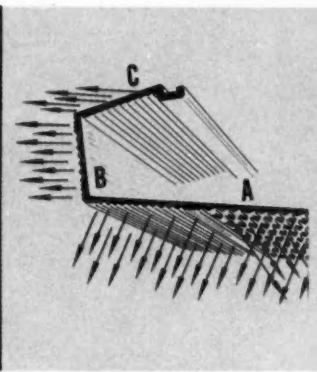
Note the clean lines and simple design, in tough, injection molded plastic. Only 2½" apparent depth.



A simple finger-touch latch release allows diffuser to swing down from either side.

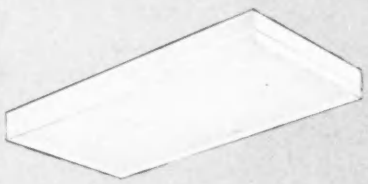


New snap-in wiring channel cover allows fixture installation and wiring to be completed in a matter of minutes.



Note how L-120 lens **(A)** diffuses light while linear refractors **(B)** direct light out of glare zone and **(C)** bend light across ceiling, eliminating "hot spots."

Here's the new line of Benjamin lighting classics for 1962



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CUTLASS — New "Light-Frame" Troffers

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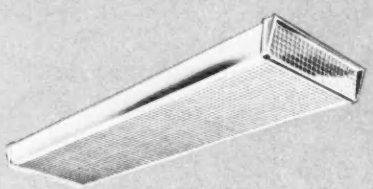
CORONADO — With 3-in-1 Diffuser



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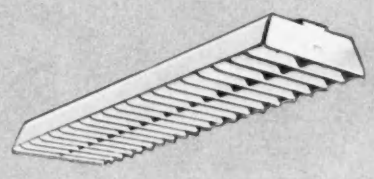

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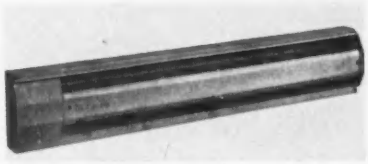
T O D A Y

Product News

Fire Pump Controllers (1)

A new line of fire pump controllers has been announced. Available as across-the-line and primary resistor manual and automatic controllers, they are constructed in accordance with the May, 1960 NFPA requirements. They are listed by UL. Units are front accessible and front operated to provide a design which can be positioned tight against a wall or mounted side-by-side with other equipment. These controllers offer as standard equipment new timers, relays, oiltight pushbuttons, indicating lights and contactors. Standardization now allows Size 3-4-5 across-the-line and primary resistor type designs to be accommodated within their respective, same size enclosures.

Cutler-Hammer, 315 North 12th St., Milwaukee 1, Wis.



Baseboard Heater (2)

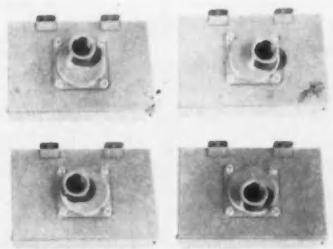
A new low-level baseboard heater features a junction box at one end, allowing for easier wiring and location of thermostat or receptacle plugs. A patented cast-aluminum heating element and full-length safety switch is used. Unit is finished in bronze and available in four lengths, 36 in., 52 in., 68 in. and 100 in. Ratings are 500, 750, 1000, and 1500 watts at 120, 208 or 240 volts. Larger capacities are available in same lengths in high-density series.

Electromode, P. O. Box 1052, Rochester 3, N. Y.

Speed Drives (3)

Mechanical adjustable speed drives, named AdjustiFlow drive, for all industrial applications in ratings from 1 to 25 hp and 1.7 to 4000 rpm output speeds available. The drive offers over 200 different predetermined speed ranges. Operating speeds from 1 up to 10,000 rpm are available through a combination of basic drive with an integral Moduline speed reducer or speed increaser. Each unit is designed for nameplate horsepower at the output shaft.

Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.



Interchangeable Hubs (4)

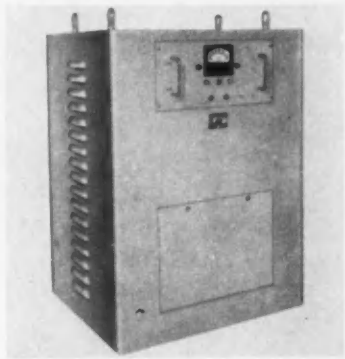
New interchangeable hubs can be mounted in four different positions to aid in aligning with conduit. Each cabinet has a plastic gasket which is captive, and provides a seal and resistance to "weathering." All hubs have built-in conduit end stops. They are available in ¾-in. to 2½-in. sizes.

Wadsworth Electric Mfg. Co., Inc., Covington, Ky.

Switches (5)

Two basic designs in heavy duty momentary contact ac switches have been announced. Each is single pole and engineered for two circuits. Lock switches are available, as well as standard switches with ivory or brown plastic handles. The "off" position is at center of handle of key throw. The two circuits are energized at either end of handle or key throw. They are side wired with large silver alloy contacts mounted at each nodal point. They have large head binding screws which accommodate No. 12 gauge wire. Tumbler switch handles fit into openings in standard wall plates.

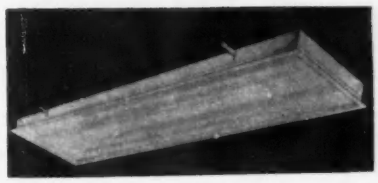
Pass & Seymour, Inc., Solvay Station, Syracuse 9, N. Y.



Regulators (6)

New Stabiline automatic voltage regulators have been introduced for larger kva requirements. Called the EMS series (electro-mechanical transistorized), they feature a completely transistorized, plug-in type control circuit. Types are available for single or 3-phase duty with ratings from 25 to 275 kva. Several types have individual line control for greater application flexibility. Especially well-suited for the heavier load requirements of radar and missile support systems, communications duty, large computer installations and a wide range of industrial voltage control applications. Bulletin S461EMS is available.

Superior Electric Company, Bristol, Conn.



Troffer (7)

A new "Cutlass" commercial fluorescent troffer has been announced. Fixtures are framed on all four sides by a mitered edge. This feature presents a picture-frame appearance. The shallow 4¼ in. overall depth allows the plenum space to be reduced to a minimum. Flanged units fitted with special swivel-bar hangers offer positive adjustment. The recessed mounting series is available in 2 by 2, 1 by 4, 1 by 8, 2 by 4, 2 by 8, or 4 by 4 troffers for 2- or 4-lamp rapid-start arrangements. The 4 by 4 is available in 4-, 6- or 8-lamp construction.

Benjamin Division of Thomas Industries, Inc., Louisville, Ky.

NEW
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20 AMP
RECEPTACLES

Now a truly complete line of 20 amp/125 volt, "U"-ground receptacles to meet the new NEC requirements. Only Sierra offers these devices in both conventional styling and smart rectangular Sierraplex design... and in four stock colors.

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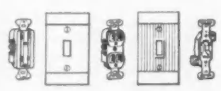
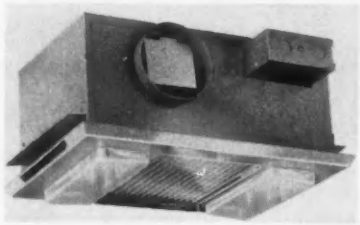




Ventilator Light (8)

New bathroom ventilator-light, known as Model X-655-S, incorporates new stainless steel snap-out grille. Ideal for modern bathrooms, unit features 120 watts of light diffused through clear refracted glass drop lenses. A built-in low-power night light eliminates groping for the lightswitch by providing illumination throughout the night. Ventilating action is by an impeller unit mounted for quiet operation. Over-all dimensions of ventilator-light, at the ceiling surface, are 10 by 15½ in. Accessories available include roof jack, wall cap and timer switch.

Fasco Industries, Inc., Augusta at North Union, Rochester 2, N. Y.

Furnaces (9)

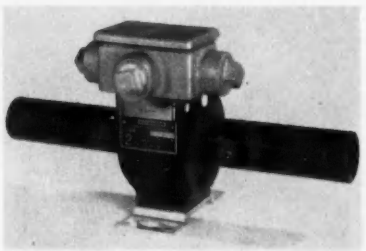
A new line of electric furnaces, designed to permit installation of a central air conditioning unit at a future date. Furnaces are available in two ratings: 10 kw with 34,000 Btuh output, and 15 kw with 51,000 Btuh output. When thermostat calls for heat it will energize a control heater in the relay box which, one minute later, will turn on the first heating unit. As this unit begins operation, it will, in turn, activate the control heater in the next relay box. Furnace blower will be started by a conventional furnace fan switch when bonnet temperature reaches 120°F. Dimensions for both sizes of furnaces is 55 in. in height, 22½ in. in width, and 26 in. deep. Blower motor for the 10-kw furnace is rated ¼ hp, and the 15-kw unit is rated ⅓ hp. Both motors can be adjusted for any one of five speeds.

General Electric Co., Central Air Conditioning Department, Tyler, Texas.

Fittings (10)

A new line of pressure cast fittings, called "Bi-Line," has been announced. There are approximately 66 new items in this line. Some of the items included are: a complete line of set screw and compression type EMT fittings; brass-ground clamps, complete line of non-metallic cable connectors and flexible steel conduit connectors; aluminum entrance ells; pull-corner elbows; offset connectors; conduit bushings and box nipples.

Blackhawk Industries, Dubuque, Iowa



Instrument Transformer (11)

A new through-type instrument transformer with unlimited short circuit capabilities for measuring line current on circuits up to 15 kv has been introduced. Basically it is an epoxy molded Type TWM current transformer with porcelain sleeve molded in the window. Designed for indoor or outdoor installation, this transformer is applicable for sensing line currents or VAR's for capacitor switching controls. Transformer can be used with both cable and bare conductor. The porcelain sleeve used on the 200:5 amp, 15-kv unit has a 1½-in. dia. opening. This arrangement can also be furnished on any standard TWM rating for 8.7 or 15-kv class service, and dual ratio 200/400, 300/600 and 400/800 sizes, all designed to accept a secondary 4-way outlet conduit box when needed.

Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.

Winding Head (12)

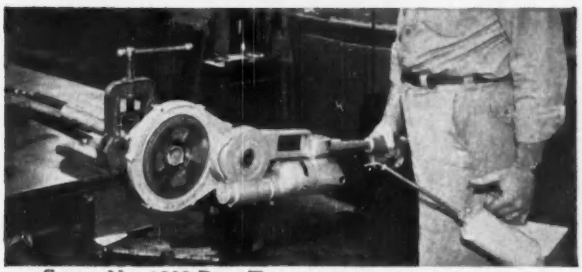
A new Universal coil winding head adapts to all types of winding for electric motors from ¼ to 50 hp. Six independently adjustable spindles can be set-up for either rectangular or diamond coils. Finger styles are available to meet all requirements—single phase, large and small 3-phase, round nose, and a special collapsing finger with a bull neck mechanism to allow coil removal. Total weight of unit is 54 lb, including fingers. It will mount on an 8-in. or larger face plate in a machine having a 20-in. or larger swing.

Owen Engineering Co., 607 *West B St., Wilmington, Calif.*

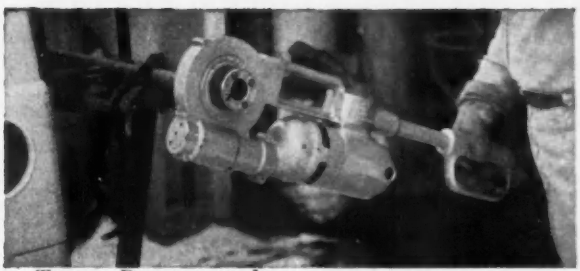
"Nothing Ever Saved More Time....."

than the new SIOUX Power Pipe Threader!

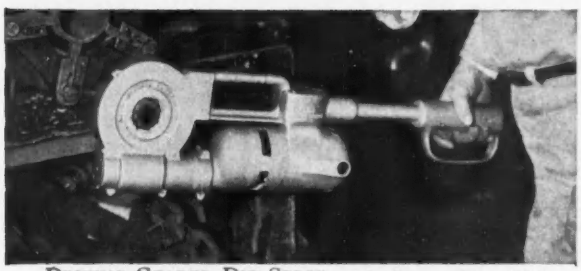
WITH THE SIOUX POWER PIPE THREADER you can thread ¼" to 1" pipe in 20 seconds; 1" and 2" pipe in one minute, 24 seconds! When labor costs 6½ cents per man per minute, a power tool like this for which there is a continuing need doesn't take long to pay for itself. The SIOUX Power Pipe Threader is said to be saving more time and money than any other major portable power tool!



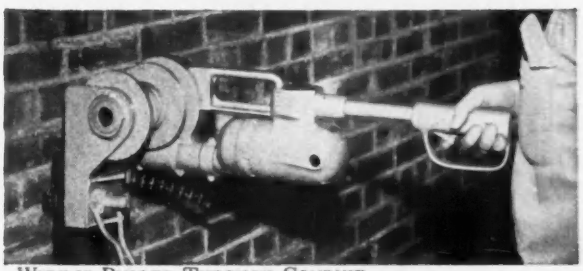
SIOUX NO. 1508 PIPE THREADER in use with No. 1511 Speed Reducer.



THREAD PIPE ON THE JOB, in a hurry. Once the unit is in place it only takes one hand.



DRIVING GEARED DIE STOCK with SIOUX No. 1508 Pipe Threader and No. 38002 Adaptor.



WIRE IS PULLED THROUGH CONDUIT with SIOUX No. 1508 Pipe Threader and No. 1509 Portable Winch.

Your SIOUX Power Pipe Threader will also thread bolts; drill; auger; and open and shut valves. (It's a versatile, portable power package!)

Look for SIOUX in the yellow pages under "Tools, Electric" or write to

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AIR IMPACT WRENCHES * AIR SCREWDRIVERS * ELECTRIC IMPACT WRENCHES * DRILLS * SCREWDRIVERS * GRINDERS * SANDERS * POLISHERS * FLEXIBLE SHAFTS * PORTABLE SAWS * VALVE GRINDING MACHINES * ABRASIVE DISCS

SAVE TIME! End guesswork with

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Beam Clamps

Universal Stamped Steel or Malleable Iron

Minerallac is the originator of the Universal Stamped Steel Beam Clamp. Minerallac is the only manufacturer that supplies both Stamped Steel and Malleable Iron types.

MINERALLAC UNIVERSAL BEAM CLAMPS

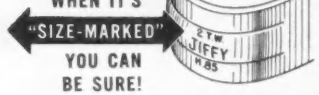
For mounting Hangers on I-Beams. Mounts Minerallac hangers No. 0 to No. 6 on I-Beams without necessity of drilling holes. Has ¼-20 tapped holes. Fits beam flanges up to ½" thick. Low cost.

MINERALLAC MALLEABLE IRON BEAM CLAMPS

Designed for maximum strength without excess weight. Cadmium plated for maximum rust protection. All sizes have throat openings to accommodate up to ⅞" flange. Set screw tapped at angle to give locking action on beam. NO DRILLING HOLES.

Exclusive Feature!

Each Minerallac fitting is "SIZE-MARKED". All are clearly and individually stamped with its exact size for immediate identification and quick and easy handling. Ends time-consuming guesswork and costly mismatches in the stock room and on the job.



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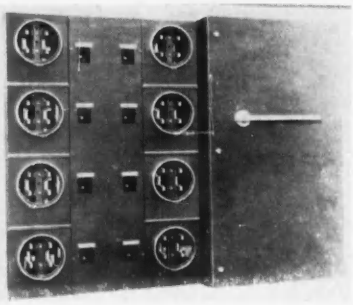


Meter Centers (13)

One of the major features of the new wall-mounted meter centers is the complete factory bussing, and elimination of load wireway sections. Wiring space is provided within the two components—service-entrance section and meter-breaker section. The wall-mounted EQ meter center is designed to be used in all separately metered multiple-unit buildings such as apartment houses, office buildings and shopping centers. A selection of four types of service-entrance sections are available—a 12-in. wide main fusible pullout for services of 200 amps or less; a main fusible switch, 24 in. wide, for services up to 600 amps; a main circuit-breaker disconnect, 12 in. wide, for services of 200 amps; and a service-entrance terminal box, but only necessary when a remote main disconnect is used and meter-breaker section is wired as a main lugs only section. Meter-breaker distribution sections, 31 in. wide, are available in 5, 6, 7 and 8 gang. Bulletin 9001-1A is available.

I-T-E Circuit Breaker Co., P. O. Box 2384, Station D, Atlanta, Ga.

Telephone Block (14)

Telephone station blocks for use with flat conductor, adhesive backed inside station wire have been announced. Engineered to speed installation, the new nylon block is designed for connecting the flat conductor cable to either station wire or line cord. Block is available in five decorator colors.

Thomas & Betts Co., Inc., Elizabeth 1, N. J.

Light Control (15)

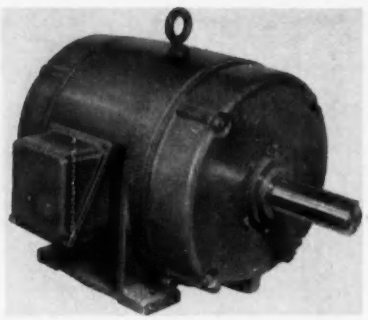
An electronic light control no larger than an on-off light switch is now available. The new dimmer, known as Luxtrol Light Control, Type SBD 500, will dim, blend or brighten up to 500 watts of incandescent lighting on a single circuit. SBD 500 fits in the same wall box that now holds the on-off switch. Once installed, Luxtrol gives continuous, uninterrupted dimming from off to full brightness.

Superior Electric Co., Bristol, Conn.

Meters (16)

A new line of Type B ampere-hour meters is now available for control of lead-acid and nickel-iron-alkaline electric storage batteries. Five types are available in either back-connected construction for panel mounting, or in bottom-connected construction for surface mounting. All types continuously measure the state of battery charge or discharge. From one to three Microswitches are installed on the meter register to control discharge-limiting accessories and battery charging equipment. An over-charge control is available for automatic over-charge by specified percentages.

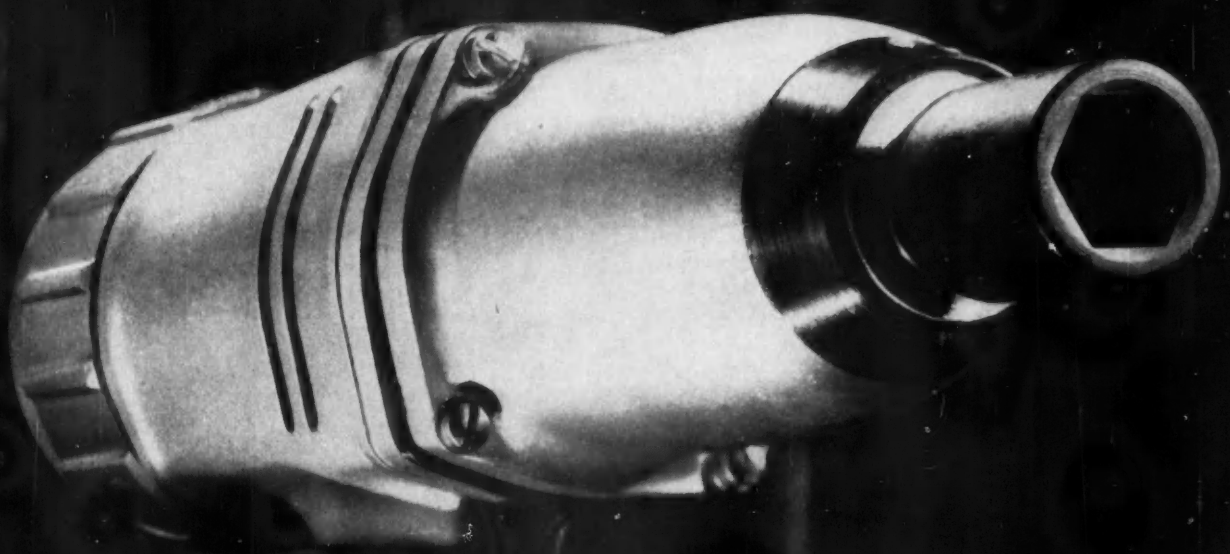
Sangamo Electric Co., Springfield, Ill.



Motors (17)

A line of open-type electric motors suitable for use in many locations with humid or corrosive atmospheres. Insulcoat motor windings are encased in an envelope of epoxy resin, applied by the fluidized bed process. Exposed inner surfaces of the motor, including frame, rotor and shaft, endplates, bearing caps and blower shields, are given a rust inhibiting finish. Ball bearings at each end are of two-cap design, and an external rotating shaft seal is provided on the drive end. Insulcoat motors are available in frames 445U and smaller, using random wound stator windings. Larger open type motors, with form wound windings, can be supplied with silicone rubber insulation for application under the same types of adverse conditions.

Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 33, Mo.



Pull that trigger and you'll get life!

Long life is just one of the reasons you'll swear by Black & Decker Electric Impact Wrenches. Built to stand up against breakdown, these heavy-duty tools also put power against tough jobs, stay cool when the going's hot. General maintenance? Model #624, with its ½" bolt capacity, lets you spin through those jobs quickly. For heavier work, try Model #625. Its ⅞" bolt capacity helps you back out "set" bolts smoothly.

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MAKER OF THE WORLD'S FIRST CORDLESS ELECTRIC DRILL

Both models are easy to handle—and they stay on the job! Black & Decker Heavy-Duty Impact Wrenches are sold by leading distributors everywhere. *For sales or service, look in your Yellow Pages under* TOOLS ELECTRIC

THE BLACK & DECKER MFG. CO., Dept. 1204
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Which battery advantage do you need most: long life, low cost, small space, easy maintenance? Ask Exide for a recommendation based on engineering facts.

Each of these Exide stationary batteries is best for certain switchgear applications. But no one battery type is best for every application. To get the maximum battery economy and performance in your application, you need the broad range of choice only Exide offers. Talk with your Exide representative and get a recommendation based on engineering facts. For literature, write Exide Industrial Marketing Division, The Electric Storage Battery Company, Philadelphia 20, Pa.

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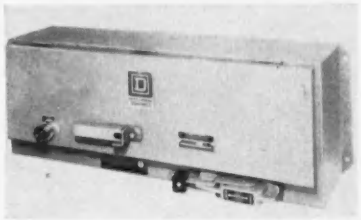
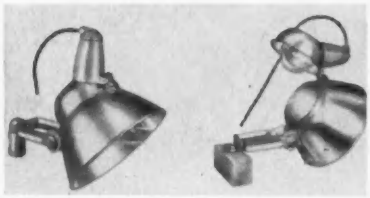


Starter **(18)**

A new line of horizontally mounted combination starters, ideal for locations where height is a limiting factor. Only 9⅛ in. high in NEMA Size 1, the starters can be used to advantage on conveyor lines, low benches and similar low profile machines. For safety, a new disconnect switch and door-closing mechanism have been incorporated in the new design. The disconnect operating handle is permanently attached to the visible blade. The handle is always in control of switch, regardless of whether the door is open or closed. The door cannot be opened with the switch "on" unless a bypass is operated, and switch cannot be operated unless door is completely closed and sealed. Fuse clips are interchangeable and can be spaced to accommodate either 250- or 600-volt fuses. Literature is available.

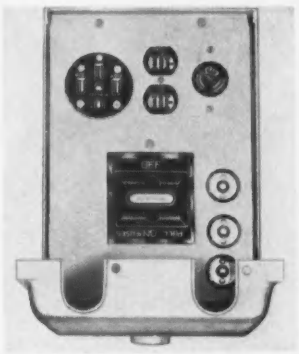
Square D Company, 4041 N. Richards St., Milwaukee 12, Wis.



Floodlight **(19)**

New, improved Series 2050 rear-service floodlight for 750,- 1000,- 1500-watt PS-52 and 400-watt mercury lamps. Series includes units for virtually every application from very long range to short range. Floodlights are available in 20-in. dia. with 20° or 50° beam spread, and 18-in. dia. with 35° or 75° beam spread. Units have built-in front and rear sights for aiming floodlight and aligning lamp filament. New design refinements include improved hinge and latch arrangements for securing front and rear reflectors; socket housing and rear reflector can be locked in open position; a rotation stop permits entire unit to be rotated upward. Mounting arrangements include slip fitter for 1½-in. or 2-in. pipe, cross arm fitter, clamp fitter, and bracket for wall mounting. Bulletin 100-6 is available.

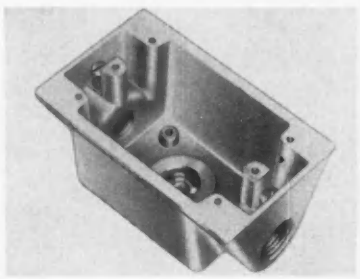
Revere Electric Mfg. Co., 7420 Lehigh Ave., Chicago 48, Ill.



Power Outlets **(20)**

A new series of UL listed, all-purpose, weatherproof power outlets for outdoor construction, industrial, farm and mobile home park use has been announced. This P-70 series has a total current carrying capacity up to 85 amps. All units are completely weatherproof and can be padlocked to prevent tampering. Model P-73-F has three receptacles: one 50-amp, 250-volt 4-wire receptacle; one 20-amp, 250-volt, 3-wire, T. L. receptacle; and a duplex 125-volt receptacle. Top hub and knockouts facilitate overhead and underground connections.

Midwest Electric Products, Inc., Mankato, Minn.



Fitting **(21)**

A flush switch fitting, known as "Multiversal," has been developed. The die-cast aluminum fitting accepts any standard wiring device, and can be used for thinwall or threaded conduit. It is available with one or two hubs, for straight line or right angle conduit runs. It is corrosion-proof and weatherproof. It accepts any standard fitting covers.

Killark Electric Mfg. Co., 411 North 10th St., St. Louis 1, Mo.

WHEN REGULAR LIGHT FAILS

THIS LIGHT GOES ON

EXIDE LIGHTGUARD®

Easy-to-install emergency lighting unit. Goes on automatically when your regular power fails. Just plug into outlet—that's all you do. Protects you from risks of sudden darkness—panic, injury, damage, theft. Low in cost. Built-in charger keeps powerful Exide battery ready for use at all times. Several models. See them at your distributor's. Or write Exide Industrial Marketing Division, The Electric Storage Battery Company, Philadelphia 20, Pa.

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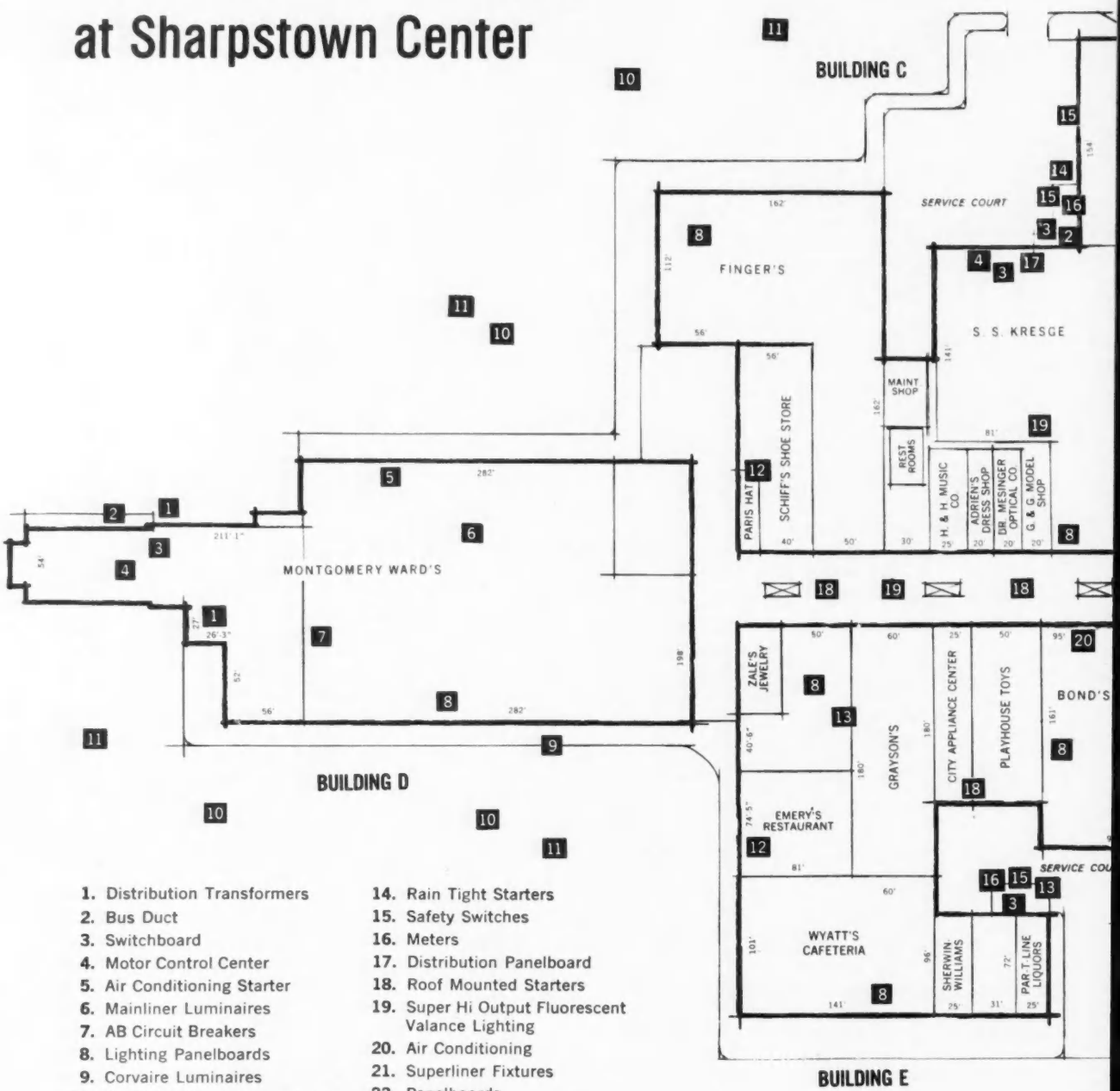
Westinghouse does a Texas-size electrical job at Sharpstown Center



1. Distribution Transformers
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3. Switchboard
4. Motor Control Center
5. Air Conditioning Starter
6. Mainliner Luminaires
7. AB Circuit Breakers
8. Lighting Panelboards
9. Corvaire Luminaires
10. OV-50 Parking Area Luminaires
11. Mercury Vapor Lamps
12. Circuit Breakers
13. Dry Type Transformers
14. Rain Tight Starters
15. Safety Switches
16. Meters
17. Distribution Panelboard
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19. Super Hi Output Fluorescent Valance Lighting
20. Air Conditioning
21. Superliner Fixtures
22. Panelboards
23. Incandescent Downlighting
24. Lifeline Motors
25. Motor Control

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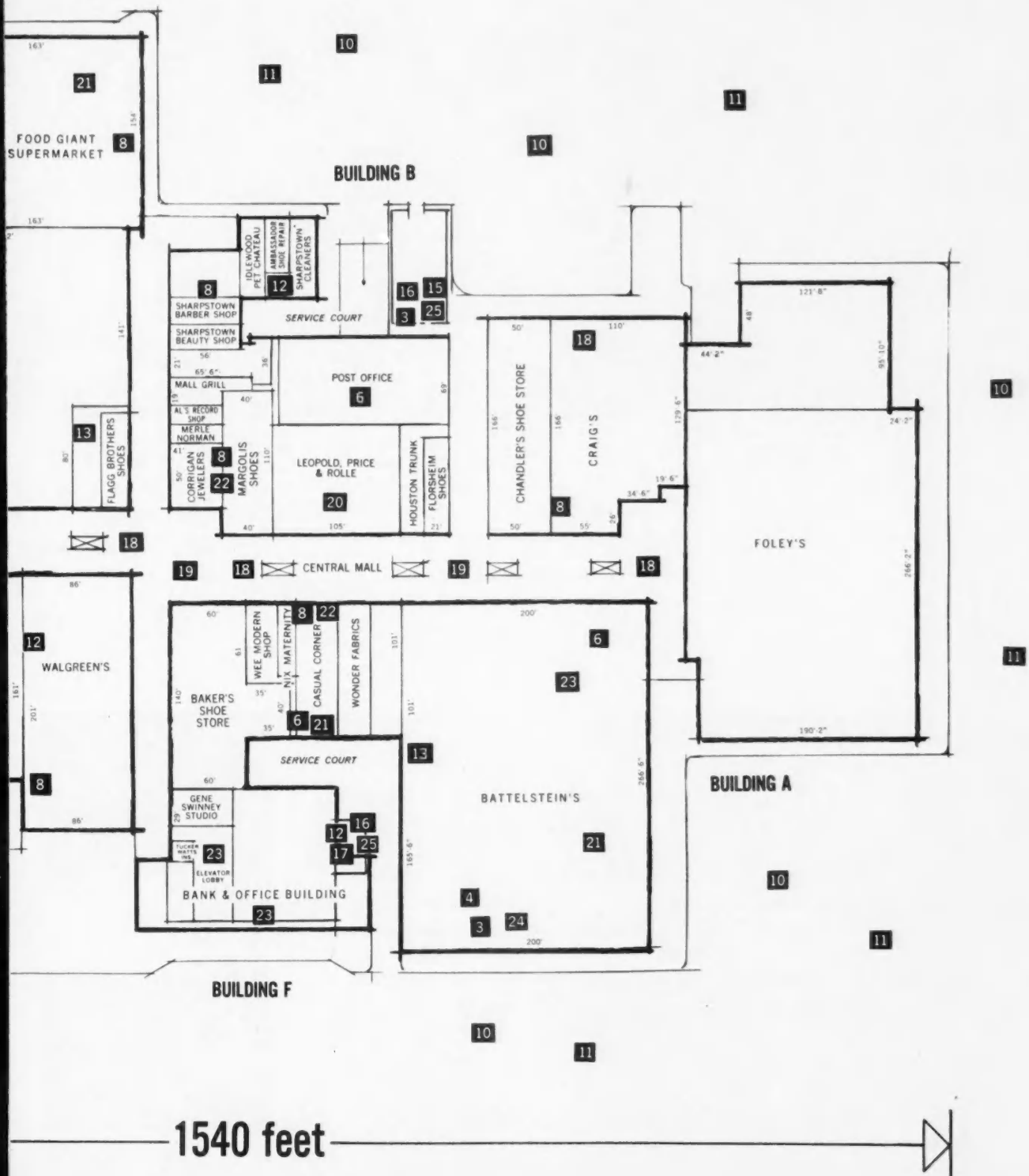
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GENE SWINNEY STUDIO
TUCKER WATTS INC.
ELEVATOR LOBBY
BANK & OFFICE BUILDING
BATTELSTEIN'S
BUILDING A
BUILDING F
1540 feet

J-94186-2

Owner: Sharpstown Realty, Houston • Architect: Sidney H. Morris, Chicago, Ill. • Associate Architect: Claude E. Hooton, Houston
Consulting Engineers: Bullock, Wright, & Miller, Inc., Houston • Electrical Contractor: Wert Sharp Electric Co., Houston
General Contractor: John C. Burns Construction Co., Houston • Westinghouse Distributor: WESCO, Houston

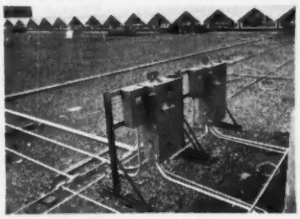
Westinghouse at Sharpstown Center (cont.)

Houston's new 750,000 sq. ft. Sharpstown Center looks to Westinghouse equipment to help accommodate 2 million customers—an estimated $75,000,000 market. Big, even for Texas, Sharpstown's 77 acres include 2 million sq. ft. parking area for 6,000 cars. It's on 261 overhead parking lights that the Westinghouse brand first meets and greets the shopping public.

The major construction problem was coordination of mechanical and electrical system requirements to give all stores the best merchandising environment possible. Westinghouse engineers and WESCO representatives from the Houston distribution outlet worked closely with the developer, consultants and contractor to meet tight dates, sometimes with overnight deliveries. The grand opening was on schedule, just three days after Hurricane Carla, in September, 1961.

Westinghouse, and its chain of distribution outlets, stands ready to help any shopping center project—be it a neighborhood strip or a $14 million Sharpstown. You get one-stop shopping, one source, one contact, one contract, one responsibility. Think about it for your next project. *You can be sure . . . if it's* **Westinghouse**

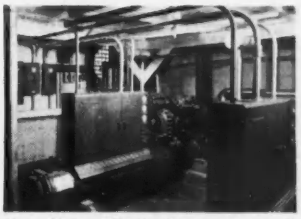
Foreground: Two of 261 OV-50 Silverliners, an invitation in light to 6000 car parking. Rugged OV-50's were subjected to Hurricane Carla shortly after installation without a single unit failure.



Roof-mounted Life-line starters and circuit breakers in weather-proof enclosures control and protect mall air conditioning motors.

J-94186-3

Flush trim of Ⓦ lighting panelboard blends with sales fixtures in Kresge's Variety Store. AB de-ion circuit breakers give positive protection, convenient operation.



Two 40-ton Westinghouse air conditioning compressor-condenser units keep Bond's Clothing Store cool and comfortable for customer comfort.

Westinghouse Motor Control Center located in Battelstein's conveniently groups starter and breakers. Control Centers offer flexibility through modular and interchangeable units.

No annoying power hum for Flagg Shoe customers. Light weight DT-3 dry type transformers have extremely low sound levels—can be mounted almost anywhere.

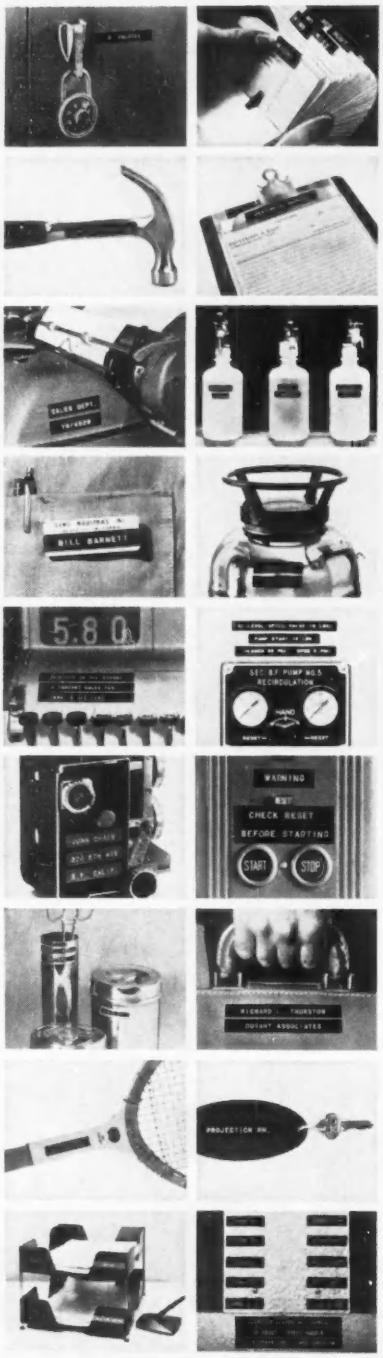
Power supply by Ⓦ outdoor ventilated copper bus duct carries full building load—installs fast to help meet construction deadlines.

Three-lamp Superliner fixtures are economical, yet versatile. Ideal light supply for applications such as this Food Giant Supermarket.

Ⓦ Mainliner fluorescent luminaires bathe fashionable Casual Corner women's wear shop in 150 fc of diffused light—create quality atmosphere vital to tenant.

Construction team takes a coffee-break at Walgreens; R. E. Jordan, V.P., Sharpstown Realty; Jacque McCroskey, Ⓦ; W. C. Swain, WESCO; Wert Sharp, Electrical Contractor; Frank W. Sharp, Owner; Rex Bullock and George Wright, Consulting Engineers.

J-94186-4



IF IT CAN BE MISLAID MISTAKEN MISFILED MISUSED MIS ANY-THING

DYMO LABELS IT

FREE demonstration of the DYMO Universal Labeling System: Your DYMO representative will call at your place of business and label any six items with the DYMO Tapewriter. See for yourself how easily you can make handsome, raised-letter labels for 1001 applications. Labels take seconds to make, cost pennies, stick permanently to almost any surface. Vinyl tape in 10 colors, plus five striped tapes. Six metal tapes. Five DYMO Tapewriter models, from $24.95. Send the coupon for a personal on-the-job demonstration ... no obligation, of course.

DYMO INDUSTRIES, INC.

Prices slightly higher in Canada.

SEND THIS COUPON TODAY...

DYMO INDUSTRIES DEPT ECM
P. O. Box 1030, Berkeley 1, California

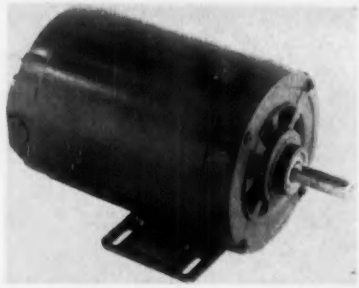
I want a demonstration of the DYMO UNIVERSAL LABELING SYSTEM, during which six items will be labeled at no obligation to me or my firm.

MY NAME _____ TITLE _____

MY FIRM'S NAME _____ PROD. OR SERVICE _____

ADDRESS _____ TELEPHONE _____

CITY _____ ZONE _____ STATE _____



Motors (22)

A new line of integral-horsepower general-purpose motors on the NEMA Size 56 frame is now available. The line includes single-phase and polyphase motors rated up to 1½ hp at 1725 rpm and up to 2 hp at 3450 rpm. Motors feature ball bearing, open, dripproof construction. This line is suited for applications such as air conditioning, ventilating fans, centrifugal pumps, compressors, pulverizers and machine tools.

Westinghouse Small Motor Division, Lima, Ohio

Connectors (23)

A heavy-duty wire connector with pressure cable and fixture type splicing has been developed. They may be used in all types of conduit, cable, non-metallic sheath and open wiring. Three sizes, Cat. Nos. Hi-3, Hi-4 and Hi-6 handle all popular wire combinations from two No. 18 up to two No. 10 with one No. 12 solid or stranded. The Hi-4 and Hi-6 sizes are UL and CSA listed as pressure cable type for general use up to 600 volts (1,000 volts when enclosed in fixture body or sign). Nos. Hi-3, Hi-4 and Hi-6 are listed as fixture type splicing for 600 volts (1,000 volts when enclosed in fixture body or sign).

Holub Industries, Inc., Sycamore, Ill.

Switch (24)

A new rocker switch, known as No. 640 ac quiet switch, has been designed to permit easy actuation of the rocker handle. Switch is of shallow body depth and takes up little room in the switch box. Both terminal screws are on the same side of the switch, eliminating the necessity of wiring it from opposite sides. There is also a 3-way version available which is known as Cat. No. 643.

Slater Electric Inc., Glen Cove, N. Y.

Cable (25)

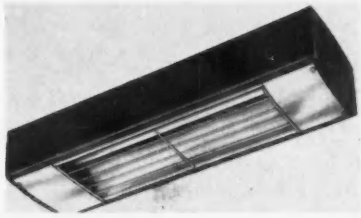
A new line of 600- and 5000-volt power cables with Vulkene insulation has been announced. Vulkene is a thermosetting insulation derived from cross-linked polyethylene. Cables are available shielded, nonshielded, and lead sheathed in power, aerial, and interlocked armor cable types for a wide variety of applications and for every type of environment. Literature is available.

General Electric Co., Chemical and Metallurgical Div., Bridgeport 2, Conn.

Connector (26)

An interlocking grip has been incorporated into a one-piece tap connector for electrical conductors. Designated "Snap-Tap," the new compression connector is supplied in an "open" position, and may be easily closed over conductors with one hand. Tap locks closed, hold the conductors in position so that lineman has both hands free to compress joint either mechanically or hydraulically. They are designed in sizes to accommodate popular distribution conductors.

Rome Cable Division of Alcoa, 793 Alcoa Building, Pittsburgh 19, Pa.



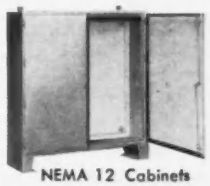
Infrared Lamps (27)

New RL Series of hi-intensity quartz infrared lamps are available in four sizes with a variety of three reflectors to fit different situations. Lengths are 18 in. and 24 in. with one or two tubular quartz infrared lamps. Lamps are in 1000 and 1600 watts, 240 volts; and 2000 and 3200 watts in 240 and 480 voltages. Reflectors are designed for 60° and 90° and asymmetrical heat-light pattern coverages. Unit is suitable for hotel or theater marquee, stores, warehouses, ramp garages, public buildings, and wherever there is a hard-to-heat location that also needs light.

Electromode, P. O. Box 1052, Rochester 3, N. Y.

the fastest label from coast-to-coast

Whenever you order *any* one of Keystone's quality wiring installation products . . . you can be sure of seeing it on your doorstep . . . *fast!* Complete stocks of Wireways, Fittings, Boxes, Cabinets and Enclosures are ready and waiting at Keystone warehouses from coast-to-coast to make sure there's *no* delay from order to delivery. You can always depend on the welcome sight of prompt Keystone service . . . *wherever you are.*


NEMA 12 Cabinets

Switch Boxes

Pushbutton Enclosures

Outlet Boxes

KEYSTONE
MANUFACTURING COMPANY
DIVISION OF AVIS INDUSTRIAL CORPORATION
23330 Sherwood Ave. • Warren, Michigan

Unusual locations?

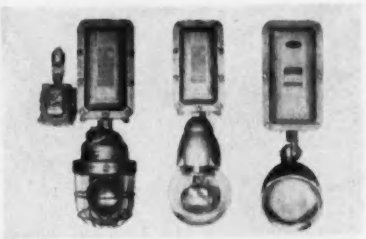
There's a PLM fitting to fit the job!

Faced with unusual mounting problems in terminating armored cable runs? Chances are there's a standard PLM fitting made to fit the job—or, if there isn't, that PLM can furnish you adaptations, *fast*, to meet your needs!

PLM flange-type terminators are supplied to fit most pothead base dimensions, and for indoor or outdoor mounting on switchgear or other applications. Other types of terminators for through, bracket or angular mounting. The complete line of PLM fittings and terminating and splicing kits for armored, non-metallic jacketed and lead-covered cable through 23 kv is described in PLM 52-page catalog 301. Write for copy on your letterhead.

PLM Products, Inc
TERMINATING AND SPLICING ACCESSORIES

3875 WEST 150th STREET • CLEVELAND 11, OHIO



Emergency Lights (28)

Self-contained automatic emergency lights for hazardous locations have been announced. Explosion-proof, dust-tight and vapor-tight models are available. The battery, automatic relay and lamp switch are enclosed in a specially sealed cast aluminum housing. Since all parts are self-contained, the entire unit can be mounted within the hazardous area. The Watchmaster lights provide illumination automatically the instant normal lighting current fails. The 6-volt dry battery will operate a 25-watt sealed-beam lamp continuously for five hours or more. Standard units are wired to detect power failure in 110-120 volt, 50-60 cycle ac circuits.

Watchmaster Division, Carpenter Manufacturing Co., 25 Bradley St., Somerville 45, Mass.

Connectors (29)

Electrical connectors—including watertight CGB and CGK cable glands and ARK-trol and Arktite receptacles and plugs—are now available with braided wire strain cable relief grips. The protective devices, called Kellems Grips, are designed to prevent cable damage caused by sharp bending and frequent pulling. They consist of multiple strands of stainless steel woven into an extensible wire mesh binding that fits around the cable entrance of connector or gland.

Crouse-Hinds Co., Syracuse 1, N. Y.

Seals (30)

A new line of Hol-Tite oil and dust tight seals for pushbutton, knockout, and conduit holes has been introduced. Although primarily designed as a positive oil and dust tight plug for extra pushbutton holes, drilling errors, conduit changes and similar unwanted openings in industrial-type enclosures, they are equally well suited for general purpose boxes. Units are available in eight different sizes for holes ranging from

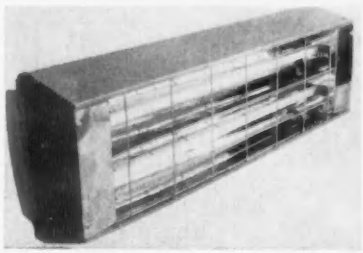
½- to 2-in. in diameter. Models to fit both standard and miniature pushbutton openings are also offered. Design features a rolled-edge covering cap made from 16 or 18 gauge steel. Cap portion is mounted in place in the hole through use of a fitted washer and plated wing nut.

Hoffman Engineering Corp., Anoka, Minn.

Grounding Receptacle (31)

A new duplex grounding receptacle series for use in homes, apartment houses, motels, hotels, office buildings, hospitals, and other buildings has been announced. Known as the No. 885 Medallion, this receptacle is designed to meet the needs of the architectural and engineering profession from the standpoint of cost, installation, speed and aesthetic requirements. Features are 8-speed wire terminals which permit internal splicing; patented side release slot and patented break-off feature for 2-circuit wiring. Available in brown, beige, ivory, white and gray. Matching wall plates are also available.

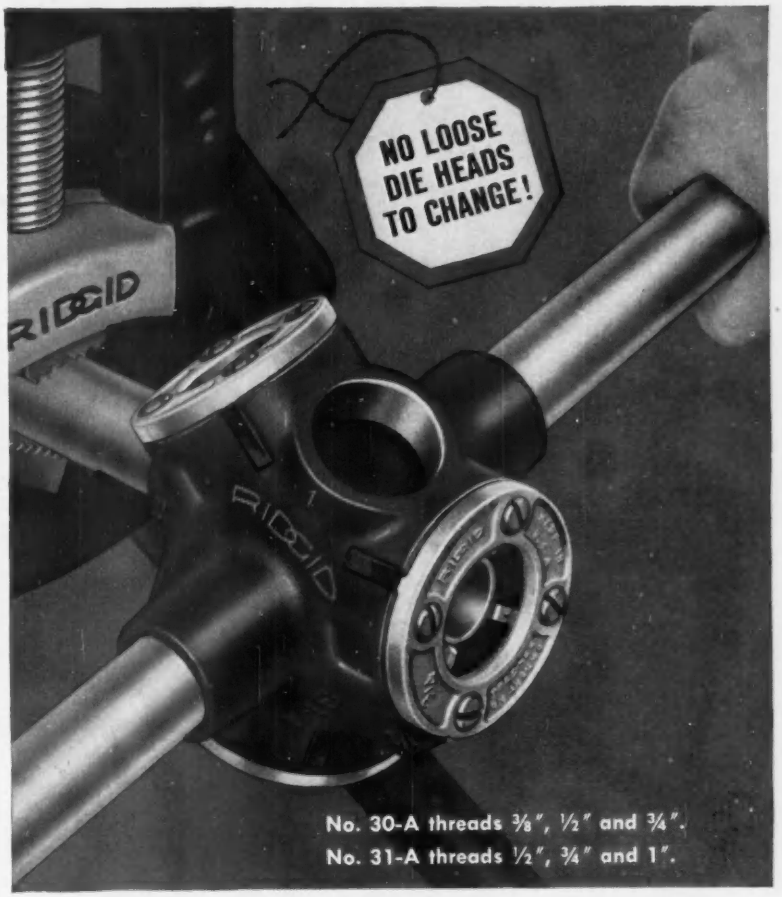
Slater Electric Inc., Glen Cove, N. Y.



Heaters (32)

A new line of 110- and 220-volt infrared electric space heaters for application both outdoors and indoors, is now available. Heaters are supplied with or without fan motor and blowers. Units equipped with blowers not only heat by radiation but also provide conventional forced warm air heating. Both types are designed to be mounted at heights ranging from 6 to 15 ft or more. Infrared units are effective where ceiling heights are 12 ft or more and in areas where partial heating is desirable. Units are listed by UL. They operate on 110 or 220 volts ac, with capacities ranging from 1500 to 6000 watts. Heating units consist of ⅝-in. fused quartz, 28 in. long with a 23-in. hot zone.

Fannon Products Div., Hupp Corp., 4199 Marcey, Warren, Mich.



...Just One RIDGID®

3-WAY PIPE THREADER

Threads All 3 Popular Conduit Sizes!

Here's an extra-sturdy threader that's instantly ready to thread any of the three conduit sizes most used. Each die-set is locked in place . . . can't get lost. Yet dies are easy to reverse for close-to-wall threading. Centering guide keeps conduit straight for true-threads every time. Twin handles double leverage for easy thread cutting. Choice of long-wearing alloy or high-speed steel dies. Straight conduit dies also available.

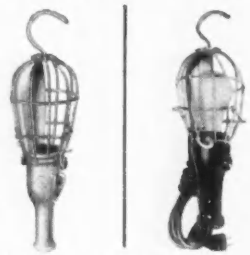
Call your distributor today. For your convenience he maintains a complete stock of RIDGID Work-Saver Pipe Tools and parts.

RIDGID

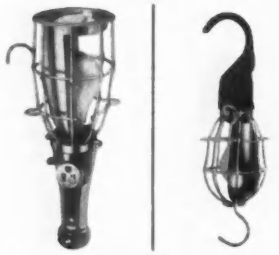
The Ridge Tool Company, Elyria, Ohio, U.S.A.

SPECIFY McGILL®

PORTABLES FOR SAFETY, CONVENIENCE AND DURABILITY



THE QUALITY LINE



OVER 100 MODELS

No. 5100 — SRG grounded portable with 15 amp., 125V outlet.

An extra margin of quality is built into the complete line of McGill industrial portable lamp guards for safe, dependable utility. Rugged, heavy duty construction and selected materials withstand the punishment of rough use.

More than 100 different types of McGill portable lamp guards have been developed to meet the particular requirements of a wide range of service conditions. Cages 50 to 200 watt. 660 watt, 250 volt sockets. Grounded, vapor-proof, double hook, reflector, concentrating end lens and many other optional features available. Most models also available with handles and cords in yellow—the accepted safety color.

Available from your Electrical Wholesaler

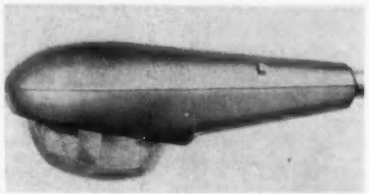
Write for McGill Electrical Specialties Catalog No. 84.

engineered electrical products

McGILL®

precision needle roller bearings

McGill Manufacturing Co., Inc., Electrical Div., 450 N. Campbell St., Valparaiso, Indiana



Luminaire (33)

A new streetlighting luminaire that has been specially designed to use mercury lamps for the illumination of residential and secondary roadways which have medium to light traffic density is now available. The unit, designated Type OV-12 Silverliner, uses 100-, 175-, and 250-watt mercury lamps. It has two-piece die-cast aluminum housing. During installation, the top of the housing is removable to permit working in a normal position. Unit comes with a built-in ballast protected by Adur-Bil insulation.

Westinghouse Electric Corp., Lighting Div., Edgewater Park, Cleveland, Ohio

Fittings (34)

A new line of insulated couplings and connectors for use with EMT has been introduced. Called "Socks" fittings, these couplings and connectors are installed by tapping them on. A built-in steel gripping ring bites into the thinwall making a positive ground and firm connection. They provide raintight and concrete tight protection for conductors, protect conductor insulation from vibration damage, chafing during wire pulling and temperature expansion and contraction. All Socks insulated throat fittings are UL and CSA listed. Non-insulated connectors and couplings are available in ½-, ¾- and 1-in. sizes. Insulated, raintight fittings are available in ½- and ¾-in. sizes.

Thomas & Betts Co., Inc., Elizabeth 1, N. J.

Vise (35)

A new portable cutting vise, called the Liquatite-Benfield vise, is for use with Liquatite flexible conduit. Vise can also be used for cutting armored cable, metal hose, copper tubing, thin wall conduit, metal molding, and any light gauge metal or plastic tubing. Vise can be hand-held at point of use or bench mounted in the shop. Using a standard saw blade the installer clamps the conduit in position, inserts the blade in vertical mitre

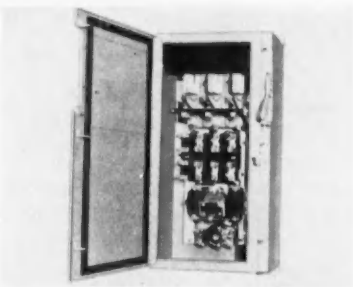
slots and saws. Vise accommodates Liquatite flexible conduit from ⅜ in. to 1½ in. inclusive.

Electri-Flex Co., Roselle, Ill.

Cross-Over Assembly (36)

A conduit Cross-Over Assembly for underfloor duct and header duct electrical systems has been introduced. The assembly consists of two gray-iron castings with conduit openings for either ½-in. rigid conduit or ¾-in. electrical metallic tubing. A shallow ½-in. by 1½-in. steel raceway cross-over, of any specified length, joins the two conduit adapters. Known as Catalog No. 326, it facilitates the crossing of any number of underfloor ducts or other raceways with branch-circuit conduits.

Wheatland Electric Products Co., 500 Logan St., Carnegie, Pa.



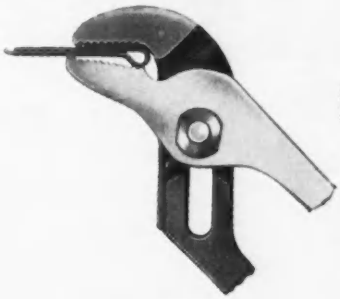
Starter (37)

New Bulletin 9589 Type SF (Safety First) ac magnetic combination starter line addition meets the industrial requirements for high production, maintenance standards and safety for plant personnel. Starters feature a completely visible blade disconnect switch, and a door interlock latch mechanism which is enclosed. Available in both NEMA 1 and NEMA 5-12 enclosures, the interlocking system is entirely front operable to allow gang-mounted applications. The interlock system prevents opening door with power "on," or turning power "on" with door open, without authorized personnel first defeating the interlock system with a screwdriver. NEMA Type 5-12 enclosures also have the added feature that the enclosure door must be latched and sealed. Type SF combination starters are available in NEMA Sizes 1 and 2 for non-reversing and reversing applications.

Cutler-Hammer, 315 North 12th St., Milwaukee 1, Wis.

OUTGRIPS 'EM ALL...

BIG



SMALL

Thin Nose

IN TIGHT PLACES

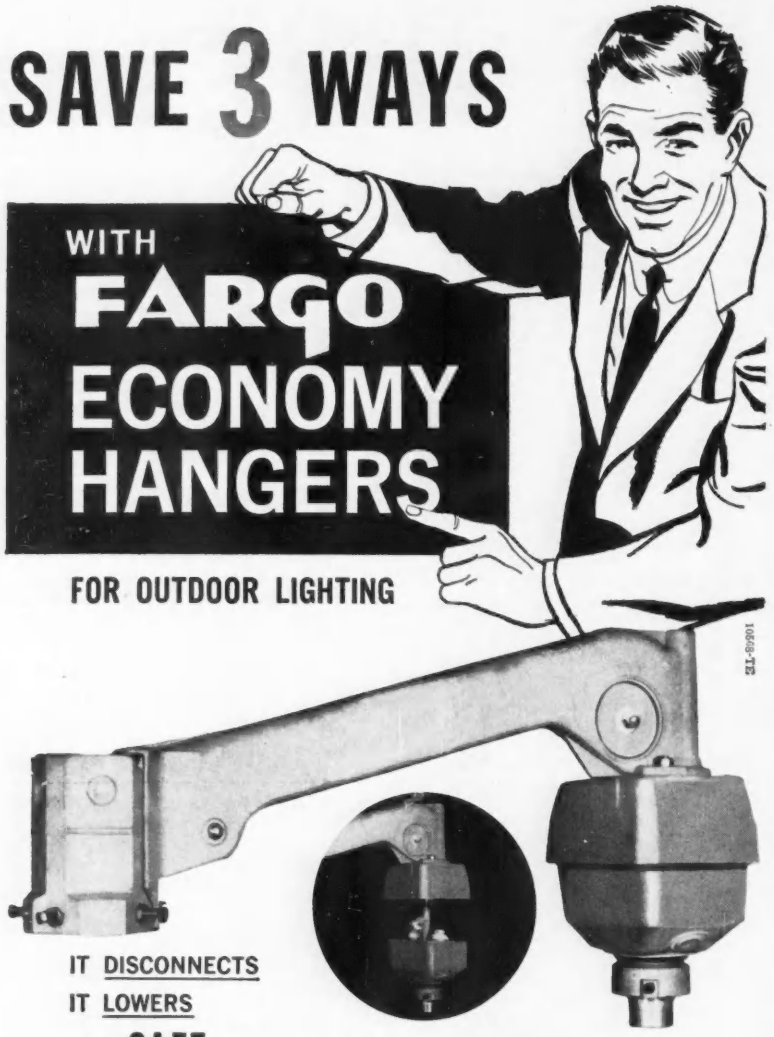
CHANNELLOCK®

Easy does it on every gripping job with a Channellock Plier in your hands. Powerful parallel-jaw grip . . . tremendous leverage . . . patented, smooth-working, can't-slip adjustments. Your choice of five jaw capacities: ½, ⅞, 1½, 2 and 2¼ inches. *Be sure it's a* **genuine** *Channellock. Look for the trademark on the handle. Write for catalog showing complete line of pliers.* Made Only By Champion DeArment Tool Company, Meadville, Pennsylvania.

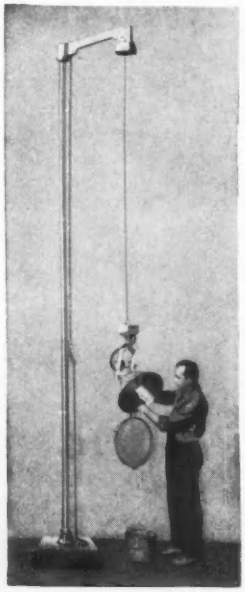
SAVE 3 WAYS

WITH
FARGO ECONOMY HANGERS

FOR OUTDOOR LIGHTING



IT DISCONNECTS
IT LOWERS
FOR SAFE GROUND-LEVEL MAINTENANCE



1. LOW INITIAL COST FOR COMPLETE PACKAGE ASSEMBLY. Integral one-piece unit of corrosion-resistant cast aluminum, featuring patented Thompson lowering mechanism, is delivered complete with all working parts . . . no assembly costs.

2. LOWER INSTALLATION COSTS. No special poles required . . . standard fittings or brackets are provided with unit. Pole top fittings accommodate two units, so fewer poles are required.

3. LOWEST MAINTENANCE COSTS. One man can service four times as many lights per hour as two men servicing fixed-position lights with ladders. No climbing or electrical dangers.

For details on Fargo hangers, write today for Bulletin F-61.

T·E THE THOMPSON ELECTRIC COMPANY
P.O. Box 873-D • Cleveland 22, Ohio

Transformers (38)

A new line of Class H dry-type distribution transformers is offered in the 600-volt class, 60-cycle, 3-phase and single-phase series. A 30-kva, 3-phase unit measures 16 in. deep, 19 in. wide and 24 in. high. In addition to the reduction in size, other major features are: low sound levels that range from 5 to 15 decibels less than NEMA standards; leads at bottom in ambient, or room temperature; low case temperatures that do not exceed a 40°C rise.

Hevi-Duty Electric Co., Electrical Division, Box 563, Milwaukee, Wis.

Humidistat (39)

Low relative humidity can be maintained at a comfortable level during the heating season with new humidistat for the control of exhaust fans. The sensitive hair-type element in the humidistat responds to the slightest change in humidity. The sensing range is from 10% to 100% with a differential of approximately 4%. The device is non-adjustable. It will fit any standard outlet box and should be installed on an inside wall away from areas which are moist or dry.

General Electric Co., Appliance Park, Louisville, Ky.

Generator (40)

A new 650-kw synchronous ac generator keeps voltage fluctuation to a minimum on sudden addition or removal of load. Compact voltage regulator is installed in the switchgear and controls the ac power that supplies the entire distribution system. The 2400-volt, 3-phase, 60-cycle generator is especially adapted for use with large constant-speed diesel engines for stationary power plants, shipboard use and other primary distribution stations and ground support equipment.

Electric Products Co., 1725 Clarkstone Road, Cleveland 12, Ohio

Fittings (41)

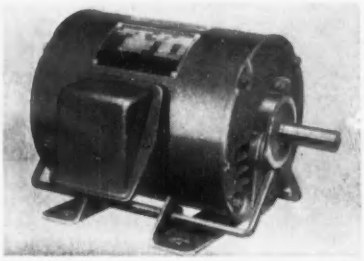
A line of all-purpose, insulated, bushed, raintight tap-on connectors and couplings which can be used wherever electrical metallic tubing is specified, has been developed. The 3-piece raintight coupling consists of two tap-on connectors plus a sleeve. All parts screw together. Fittings are listed as raintight by UL and can be used outdoors or in concrete slabs. They are vibration-proof.

Tomic Sales & Engineering Co., 20000 Sherwood Ave., Detroit 34, Mich.

Luminaire (42)

The LPI Thin-Lite Luminaire is now listed by UL for direct surface mounting on combustible, low density cellulose fiberboard ceilings. The 2⅝-in. shallow luminaire design incorporates a ballast with automatic resetting thermostat. The combination of ballast and luminaire design makes it possible to eliminate spacers between ceiling and fixture as otherwise required by NEC. Thin-Lite is available in 2-lamp and 4-lamp models with a wide variety of diffusers.

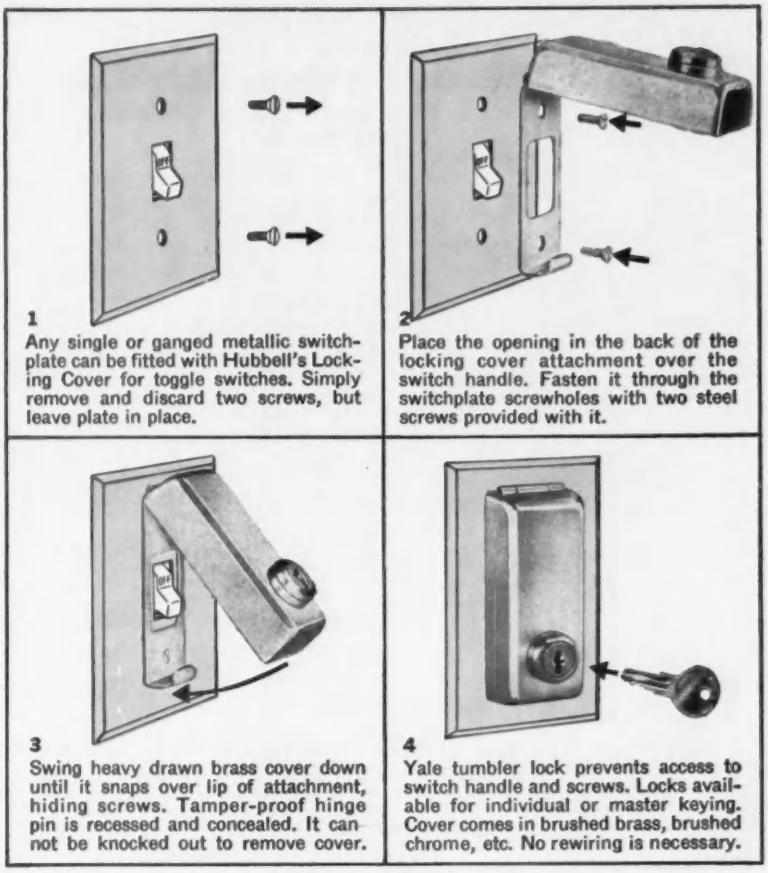
Lighting Products Inc., Highland Park, Ill.



Motors (43)

New Series 180 motors built in NEMA frames 182, 184, 213, and 215, are available in polyphase ratings from ½ to 7½ hp and capacitor single phase ratings from ¾ to 5 hp. All metal parts have been specially treated for moisture resistance. Slot cells are insulated with Mylar laminated to rag paper. Large terminal box on the polyphase type, adjustable for top, bottom, or side connection, is diagonally split to allow ample "knuckle room" when connecting leads. Both polyphase and single phase types are available in resilient base, sleeve bearing designs. On single phase type, centrifugal switch and condensers are externally mounted under weatherproof covers.

Robbins & Myers, Inc., Springfield, Ohio



1
Any single or ganged metallic switchplate can be fitted with Hubbell's Locking Cover for toggle switches. Simply remove and discard two screws, but leave plate in place.

2
Place the opening in the back of the locking cover attachment over the switch handle. Fasten it through the switchplate screwholes with two steel screws provided with it.

3
Swing heavy drawn brass cover down until it snaps over lip of attachment, hiding screws. Tamper-proof hinge pin is recessed and concealed. It can not be knocked out to remove cover.

4
Yale tumbler lock prevents access to switch handle and screws. Locks available for individual or master keying. Cover comes in brushed brass, brushed chrome, etc. No rewiring is necessary.

Locking Cover Attachments Halt Tampering with Switches

Wherever there's a reason for preventing the unauthorized operation of switches, there's a reason for Hubbell's easy-to-install Locking Cover Attachment.

Equipped with a Yale tumbler lock, this rugged accessory protects people and guards electrical equipment in plants, laboratories, hospitals, workshops, prisons, and asylums.

For buildings requiring several attachments, you may specify: (1) the same key for all locks, or (2) a different key for each lock, or (3) one key for one group of locks and other keys for other groups. Master keying is optional. To protect owners, extra keys are never supplied.

These locking covers are sold by electrical distributors handling Hubbell® wiring devices. Or write for folder and prices.

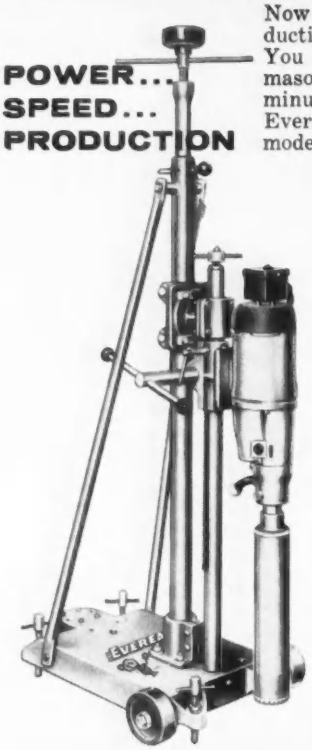
IT PAYS TO HAVE HUBBELL GOOD CONNECTIONS

KEEP PACE WITH ELECTRICITY

HARVEY
HUBBELL
INCORPORATED
Bridgeport 2 Connecticut

EVEREADY PRECISION ENGINEERED CORE DRILLS

POWER...
SPEED...
PRODUCTION



Now you can have all the Power, Speed, Production you need and want in a Core Drill. You can drill holes in reinforced concrete, masonry materials, stone, refractories... in minutes. Choose the precison-engineered Eveready Core Drill you need. There's a model for every drilling application.

CHECK THESE FEATURES:

Two-Speed Super or Two-Speed Heavy Duty Power Unit
Full 360 Degree, Any Angle Drilling
Adjustable Horizontal and Vertical Bracing
Thermal Motor Protector and Overload Clutch
Dual-Column Design and Column Stabilizers

Eveready Super Duty CD-180-360 Degree, any angle drilling for holes up to 14" in diameter. Equipped with a 2-Speed, Super-Duty 18-Ampere Power Unit. Change speeds instantly with a shift of the lever. Instant choice of the most efficient speed for the size of the bit and the material to be drilled. Develops up to 3½ H.P. rated load at speeds of 210 RPM and 550 RPM. 115 Volt or 230 Volt. High-strength aluminum housings.

Special heat treated gears. Thermal Motor Protector eliminates motor "burn-out". Overload Clutch protects motor, gears, and bit. Built-in water swivel assures ample, even flow of water to the bit. Easily attached Vacuum Hold Down Unit.

Heavy Duty CD-120—has all special and exclusive features of the Super Duty CD-180 except comes equipped with 2 Speed, Heavy Duty, 12 Ampere Power Unit for drilling holes up to 8" in diameter.

Compact CD-100—for drilling holes up to 4½" in diameter. Equipped with special 10 Ampere single-speed power unit. Gear change kit available. Develops up to 1⅓ H.P. High strength aluminum housings... ventilated for cool operation... heat treated gears. Motor can be removed and converted to hand held drill with purchase of optional Handle Kit... Thermal Motor Protector... Adjustable Jack Screw for vertical bracing.

EVEREADY DIAMOND CORE BITS

WITH BUILT-IN ADAPTORS

Made with Finest Natural Whole Diamonds

Now Eveready combines bit and adaptor to guarantee precision line-up... Eliminate Core Bit "run-out"... Increase Diamond Life... Assure Greater Drill-Ability.

Eveready's Single-Unit Bit and Adaptor cuts out bit slippage... Stops Down Time from lost or damaged adaptor parts, as well as Down time because of wrong-size adaptor.

You can

Cut Your Drill Bill

with Eveready Diamond Core Bits

Thicker, stronger heavy-duty core barrels reduce barrel rupture to a bare minimum. Strict controls during each step in the manufacture assure uniform, top-quality bits.

Write today for the name of your nearest Eveready Distributor

EVEREADY® BRIKSAW COMPANY

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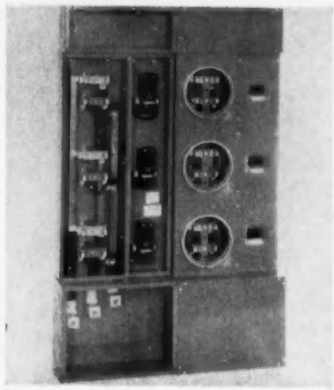


Meter Channels (44)

New standardized UL listed, factory-bussed, gangable unit meter channels each available from 2 to 6 stations high, wired from the load side of the socket to the line side of its branch-circuit breaker, are available. VBS series of panel base assemblies is suitable for service equipment and primarily designed for quick job-site flexibility, ease of mounting and wiring. Channels are all rated 100-amp, 120/240 volts per location. Each socket is spaced 10 in. on vertical centers. Fifth terminals or manual bypasses can be provided from the factory installed or be added in the field as desired. The neutral bus is insulated and groundable.

Anchor Manufacturing Co., Manchester, N. H.

Coupling (45)

A combination coupling for joining ⅜ in. flexible conduit to ½ in. EMT has been announced. The one-piece coupling can be used in any installation where EMT is to be coupled to flexible conduit such as in motor driven appliances and oil burners. It is listed by UL.

Thomas & Betts Co., Inc., Elizabeth, N. J.

Termostat (46)

A new heavy duty line-voltage thermostat to control electric radiant ceiling cable, baseboard and ceiling panel installations is now available. Wall thermostat blends with G-E's decorator wall switches so that they can be mounted side-by-side for convenience. Designed for safety, the wall thermostat, designated Type HWC-10 (single pole model), is sensitive to room temperatures with a thermostat differential of 1°F. Temperature settings range from 45° to 85°F.

All leads to thermostat connect to recessed pressure terminals at back of unit. Model HWC-11 double pole thermostat is also available. Both are equipped with locking tabs to permit a combination low temperature stop, a high temperature stop, and a locking device to keep thermostat settings between 60° and 80°F. Thermostats have non-inductive ratings of 22 amps at 120 volts ac, 22 amps at 240 volts ac, and 18 amps at 277 volts ac.

Electric Comfort Heating Section, General Electric Co., Appliance Park, Louisville, Ky.

Tool (47)

A new low velocity, piston-type powder-actuated tool, called Pow-R-Set, has been introduced. It utilizes the energy of a fired blank cartridge to set threaded studs or drive pins into steel or concrete. The tool uses this energy to activate a precision-built piston within its barrel for fastening at a low velocity. It weighs 4½ lb.

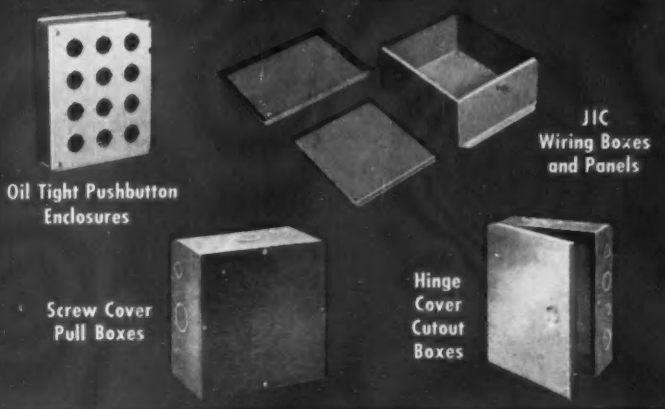
Ramset Fastening System, Winchester-Western Div., Olin Mathieson Chemical Corp., 289 Winchester Ave., New Haven 4, Conn.

Communication System (48)

A new return call telephone system, which provides two-way voice communication with a central office, and featuring a visual device which informs room occupants of unanswered calls, has been introduced. The call back indicator is a red button which snaps out to a forward position, on the room telephone face plate, when a call is made from the central office. If occupant is out, the protruding red indicator informs him, upon return, that his room was called during his absence. When he calls the central office for his message, he returns the indicator button to its normal depressed position. The room telephone unit is a loudspeaker type with a 12¼-in. by 5⅜-in. aluminum face plate, for flush or surface wall mounting. Central office telephone is available as either, flush wall unit, a surface wall model, or a console unit. Each is equipped with telephone hand set, buzzer signal and pushbuttons and card holders corresponding to number of rooms in system. The system is designed for use in dormitories, nurses' residences, motels, small hotels, etc.

Auth Electric Co., Inc., Long Island City 1, N. Y.

BOSS ELECTRICAL ENCLOSURES

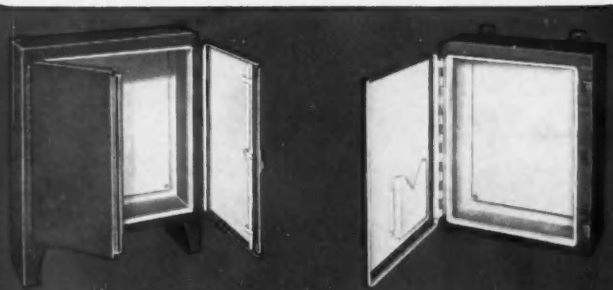


BOSS QUALITY and SERVICE

BOSS electrical enclosures and wireway are manufactured to consistent, high quality standards . . . feature baked enamel finish over phosphatized surface.

Stock items are shipped immediately from centrally located Cincinnati. "Specials" receive quick quotation and are manufactured promptly in our Cincinnati plant.

Write for BOSS complete line catalog.



BOSS Nema Type 12 Single and Double Door Enclosures

BOSS also manufactures Nema Type 1, 3 and 4 Enclosures, Disconnect Switch Enclosures and Terminal Enclosures.

BOSS JIC Flanged Hinge Cover Wireway and Fittings

Flanged Hinged Cover Wireway & Fittings
Flangeless Screw Cover Wireway & Fittings
Flangeless Hinged Cover Lay-In Wireway & Fittings

THE HUENEFELD CO.
ENGINEERED PRODUCTS DIVISION
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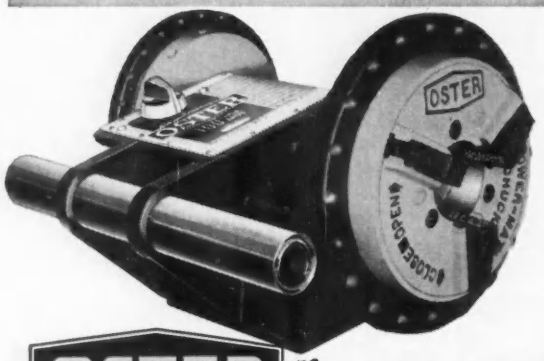
TESTED AND PROVEN . . .
THOUSANDS IN USE!



OSTER "100"
POWER DRIVE
FULL 2" CAPACITY

Here's the original, LOW PRICED Power Drive that continues to be the "first-choice" of factory maintenance men everywhere! Compact, lightweight (only 77 lbs.), the "100" is strictly a one-man machine yet does the work of *four* men! See it today.

ADD POWER TO ALL YOUR THREADING OPERATIONS

WRITE TODAY FOR COMPLETE INFORMATION

THE OSTER MANUFACTURING CO.
1313 East 289th Street, Wickliffe, Ohio, U.S.A.

Battery **(49)**

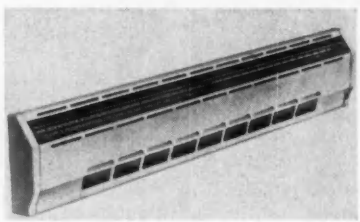
A new flat-plate lead-acid battery line, named Exide-Dynaclad, for electric industrial trucks, has been announced. The Silvium positive-plate grid is specially designed to insure evenly distributed plate strength throughout battery life. Dynaclads are equipped with easy-grip vent plugs of polyethylene. Available for all truck sizes and designed to fit all standard battery compartments, the line includes the MGP, providing 45 amp-hrs per positive plate; the RGP, giving 55-AH per positive plate; the THP, 60-AH; TGP, 72-AH; TEP, 95-AH; MXP, 125-AH; and MEP, providing 145-AH per positive plate.

Electric Storage Battery Co., Rising Sun and Adams Aves., Philadelphia 20, *Pa.*

Switch **(50)**

A quiet switch with both screw and E-Z wire pressure terminals. Switch has extra common terminal connections for continuous wiring, plaster ears, takes Nos. 14 or 12 wire—and is for use in any position with all standard wall plates. 15-amp, 120-volts, ac only. No. 1021 is single pole; No. 1023, 3 way. Both are available in brown and ivory.

Eagle Electric Mfg. Co., Inc., 23-10 *Bridge Plaza South, Long Island City* 1, *N. Y.*



Electric Heat **(51)**

Two new lines of electric baseboard heat, the "Galaxy" low density line and the "Deluxe" high density line, have been introduced. They are designed for commercial, institutional and large or small residential applications. The Galaxy 240-volt units produce wattages from 500 to 1500, progressively, in four standard sizes from 3 to 9 ft in length. The Deluxe 240-volt units produce from 840 to 2680 watts and are available in similar lengths. These slim units, 2 in. deep and 6 in. high, are finished in enamel. All units are prewired at both ends. End caps are furnished.

Arvin Industries, Inc., Columbus, Ind.

Catalogs & Bulletins

(52) ESTIMATOR Catalog No. 124 gives illustrations and prices on electrical supplies, apparatus, lamps, lighting and wire and cable. General Electric Supply Co.

(53) CABLES. New booklet gives all the facts and termination data on Type UR underground-residential cable. Okonite Co.

(54) ELECTRICAL DISTRIBUTION EQUIPMENT. 72-page Catalog 62 shows up-to-date lines of circuit-breaker equipment, fusible service equipment, safety switches and meter mounting devices. Murray Manufacturing Corp.

(55) LIGHTING. 64-page "Datalog" includes general information on lighting and specification data for nearly 100 prismatic lighting fixtures. Holophane Co., Inc.

(56) BUS DUCT. Booklet B-7360 describes plug-in low impedance bus duct. Westinghouse Electric Corp.

(57) LIMIT SWITCH. Bulletin GEA-7339 describes features of new CR115-E geared rotary limit switch for control on rotating drive shaft equipment up to 3600 rpm. General Electric Co.

(58) LIGHTING UNITS. Folio 62-1, 16 pages, describes line of cast aluminum special purpose lighting units. McPhilben Lighting, Inc.

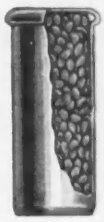
(59) MOTOR GENERATORS. 2-color folder illustrates and describes single and 3-phase alternators for producing odd voltages, phases and frequencies. Motor Generator Corp.

(60) LUMINAIRE HANGERS. Bulletin F-61 describes new "Fargo" economy disconnecting and lowering hangers for all types of luminaires. Thompson Electric Co.

(61) MAGNETIC STARTERS. 28-page Bulletin GEA-702A contains information on 100-Line design of magnetic starters and contactors in NEMA sizes. General Electric Co.

(62) LANTERNS. 4-page brochure illustrates 21 styles in four models—ceiling, wall, table and floor—and includes the large fluorescent wall or ceiling unit designed primarily for contract installation. Howard Miller Clock Co.

Here's why any powder-actuated tool works better with Remington Loads and Studs



Exclusive "Kleanbore" Priming

22 caliber Power Load (twice actual size)

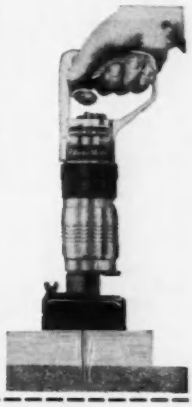
Green "Power-Guide"

¼" S-25 Stud (twice actual size)

Scientifically graded Remington Power Loads offer precise, uniform charges . . . have strong, non-rusting brass cases. Exclusive "Kleanbore" priming mixture protects bore of tool because it does not cause rust or corrosion. No need to clean barrel after every job! These quality Power Loads are subjected to multiple inspection during manufacture, are backed by Remington—a name well known to American sportsmen. No matter what powder-actuated tool you use, it will work *better* with Remington Power Loads!

Uniform performance and penetration are assured with precision-made ¼" and ⅜" diameter Remington Studs. These high-strength studs are made with special molybdenum steel. Specify Remington Studs with exclusive green "Power-Guide" heads . . . for uniform performance and straight-driving penetration. Over 60 "job-rated" Studs to choose from—your assurance of a Remington "Power-Guide" Stud to fit every fastening application.

Remington know-how insures the quality of its Studs and Power Loads. No other company can offer the background of experience gained through the manufacture of billions of these units. When you order studs and loads, you'll get better performance if you specify Remington—maker of the most versatile fastening tool ever designed (right). We'll gladly send valuable free booklets about Remington Power Loads, Studs and fastening tools. Mail the coupon today!



Remington Model 455A Stud Driver

Remington

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Remington Arms Company, Inc., Park Forest, Ill.
IN CANADA: Remington Arms of Canada Limited, 56 Queen Elizabeth Blvd., Toronto 18, Ont.

Remington Arms Company, Inc., Park Forest, Ill. EC-42

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Most complete line in the world. A style to meet every need.
Specification Devices... Ring Bells with EVERYBODY!
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Bell Ringer of the Month
Bell Boxes
All-purpose weatherproof junction boxes, rugged die cast aluminum with internal hubs: 1 and 2 gang.
SGS
Specification Grade Stainless Steel Wall Plates
Quality made of type 302 18-8 alloy, precision finished in satin luster. NON MAGNETIC, RUSTPROOF, for use in all locations where excess corrosion conditions exist. Available up to 10 gang.
TRY IT!
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30 and 50 amp flush and surface mounted . . . exclusive features for easy, fast terminal connections.
"Motor Guard" Fuse Holder Covers
Exclusive "window cover" for instant check-up . . . protects against motor burn-outs.
No-Shok Duplex Receptacles
A must for parents with children. Protects against shock, severe burns. Self closing cover.
America's Largest Line of Weatherproof Devices and Wall Plates
Contact Your Distributor or Write for Complete Catalog
BELL ELECTRIC COMPANY
5735 S. CLAREMONT AVENUE, CHICAGO 36, ILL

(63) PUMP MOTORS. 2-page Bulletin 6404 describes hydraulic elevator pump motors available in 2- or 3-phase, 60 cycles, 1-75 hp, 208, 220/440 or 550 volts. Imperial Electric Co.

(64) EPOXY RESIN selection guide chart lists 15 different Dolphon resins for application by impregnating, casting and potting, dipping, brushing and paste. John C. Dolph Co.

(65) AIR CONDITIONING for multi-room buildings is described in 20-page booklet including a chart comparing four multi-room systems of air conditioning. Air Conditioning Div., Remington Corp.

(66) INDUSTRIAL POWER TRANSFORMERS. 12-page Bulletin GEA-7525 describes redesigned line of large industrial substation transformers, rated from 10,001 to 25,000 kva. General Electric Co.

(67) SAFETY SWITCHES and AB-I breakers are compared in 8-page Booklet B-7359. Westinghouse Electric Corp., Standard Control Div.

(68) TRANSFORMERS. Bulletin CS-801 describes new 3-phase pad mounted transformer power centers available 15 kv and below through 3750 kva. Kuhlman Electric Co.

(69) THROAT FITTINGS. 4-page brochure illustrates complete line of nylon-insulated connectors, elbows, bushings, sleeves and nipples—sizes from ½ in. up to 6 in. Thomas & Betts Co., Inc.

(70) OIL CUTOUTS. Bulletin GEA-7191 provides information on application, operation and interrupting ratings of oil cutouts for electric utility and industrial plant distribution systems. General Electric Co.

(71) ARCHITECTURAL FLOODLIGHTING is described in 12-page Booklet B-8251. Westinghouse Lighting Div.

(72) FLUORESCENT BALLAST for plastic signs is described in Bulletin PFL-1061. Sola Electric Co.

(73) SILICONE DIELECTRICS. 20-page Booklet S-24 describes two basic product groups which have been designed to be used in the solution of heat transfer problems—silicone dielectric fluids and compounds. General Electric Co., Silicone Products Dept.

(74) MOTORS. 4-page Bulletin 535 describes new Series 180 polyphase and capacitor single-phase motors, rated ½ to 7½ hp in NEMA Frames 182, 184, 213 and 215. Large Motors Div., Robbins & Myers, Inc.

(75) SPEED DRIVES. Bulletin 14B-1136 describes operating principles of the "StatiFlex" adjustable speed drives available in ratings from 1 to 200 hp. Allis-Chalmers Mfg. Co.

(76) OIL-TITE PUSHBUTTONS (Type OT1) are described in 8-page booklet. Westinghouse Electric Corp.

(77) CONTROLS. 12-page product guide covers ratings and technical data on variable transformers, voltage regulators, synchronous motors, magnetic amplifiers and power supplies. Superior Electric Co.

(78) WIRING DEVICES. New booklet entitled "Rugged Twist-Lock Wiring Devices" explains and catalogs the company's line of ten different types and sizes of wiring devices for portable electrical equipment. Harvey Hubbell, Inc.

(79) MOTORS. Standard fractional hp motors which are normally carried in stock are listed in 6-page Bulletin 2820. Westinghouse Electric Corp.

(80) RADIANT QUARTZ HEATERS utilizing quartz lamps with heat sources that operate at nearly 4000°F, or quartz tubes with heat sources that heat to 1700°F, are described in Bulletin 49-536. Electric Comfort Heating Section, General Electric Co.

(81) ROOM THERMOSTATS, controls and humidistat for use with electric heating and cooling applications are described in Bulletin 49-537. Electric Comfort Heating Section, General Electric Co.

(82) ANNUCIATOR SYSTEMS. Circular describes a new annunciator system tie-in with the graphic diagram of the system on the face of the control panel. Graphics, Inc.

(83) PENDANT and cluster "bullet" fixtures designed to meet specific architectural needs are illustrated in Catalog A4. Stonco Electric Products Co.

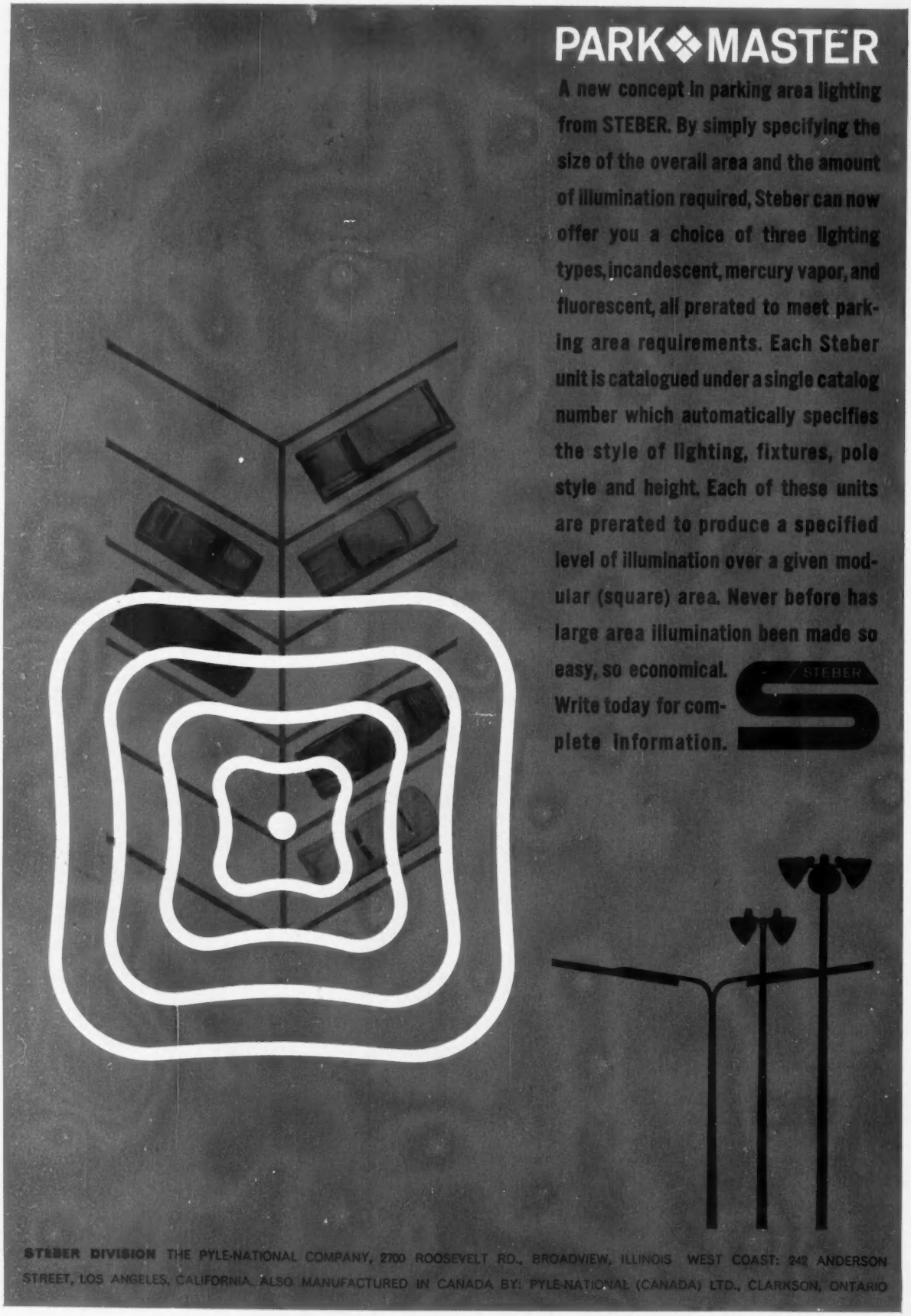
(84) SATURABLE REACTORS are described in Bulletin 615 including schematics of single and 3-phase typical reactor circuits, as well as technical data about reactive loads. Sorgel Electric Co.

1 MILLION OF THESE PROVE GAMEWELL CAN HELP YOU

The next time you see a municipal fire alarm box we invite you to go up to it and read the name on the box. 9 times out of 10 we know you'll see "Gamewell". That's pretty good proof of performance, isn't it? ■ You may not realize that Gamewell has been the choice of thousands of firms to protect industrial, commercial and institutional buildings with Flexalarm fire alarm systems inside the building. ■ Find out how our more than 100 years of specialization in the development and manufacture of automatic fire detection and alarm systems can solve your alarm system installation problems—dependably, economically and attractively. Write The Gamewell Company, Department 1403, Newton Upper Falls 64, Massachusetts. A Subsidiary of E. W. Bliss Company.

BLISS Gamewell®

FIRST...WHEN SECONDS COUNT.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A new concept in parking area lighting from STEBER. By simply specifying the size of the overall area and the amount of illumination required, Steber can now offer you a choice of three lighting types, incandescent, mercury vapor, and fluorescent, all prerated to meet parking area requirements. Each Steber unit is catalogued under a single catalog number which automatically specifies the style of lighting, fixtures, pole style and height. Each of these units are prerated to produce a specified level of illumination over a given modular (square) area. Never before has large area illumination been made so easy, so economical.
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Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installations, maintenance and repairs. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

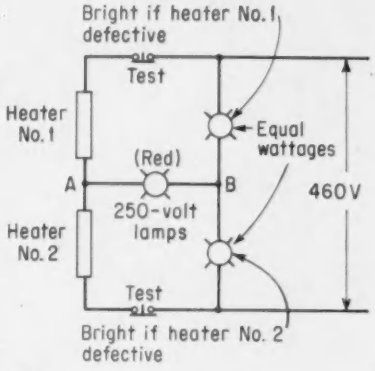
Pilot Signals for Heaters

QUESTION V40 — In the plant where I work, we have what is known as a tile machine on which we make ceiling tiles out of insulation fiberboard. On this machine we have some heating irons with which the bevel edges of this tile are seared. These heaters are constructed using two Chromalox tubular elements, each 675 watts, 230 volts in series and using 460 volts. Now the problem is, if one of these goes out the heating stops and causes cull tiles. The production engineer wants to put pilot lights on each heater so that if one of the heaters goes out, the pilot light will immediately let them know about it. These heaters have thermostats, and I have considered using a small contact thermostat set just under the heat of the heater thermostat so that if the iron cools a few degrees under that for which the heater thermostat is set for it will either turn a light off or on, whichever is desired.

Please let me know what your solution to this problem would be. —R.A.W.

ANSWER TO V40—The thermostat would be nice if you can get away with a 25 degree differential, so then the heater thermostat is set at the top of the 25 degrees, while the signal thermostat would be at the bottom of the 25 degree range. A better system would be a capillary, thermocouple, or resistance thermometer with the reading device next to the party who has to look at the light. This way you can stay at a very narrow differential.—H.S.

ANSWER TO V40—Your problem can readily be solved with the additional thermostat the way you suggested. Another still more simpler method is the use of control lights. They would, however, not work in the way of pilot lights, i.e., across the heaters. The light would still be on even with the heater defective. By establishing an artificial midpoint, as shown on the accompanying sketch, a positive and nonfailing indication is available to



Note:
Normal – No potential difference between A and B
Fault – Size of "L" will determine voltage difference between A and B

show immediately when a heater failed and which one.

Use 250-volt bulbs, any wattage. To augment safely from failure, two bulbs may be paralleled or a test switch incorporated as shown. With a fault, the voltage between A and B will depend on the size of the red lamp.—K.H.

Checking Motor-Lead Polarities

QUESTION W40 — We rewind many fractional hp split-phase stators with three leads. Is there any simple method to determine specific rotor rotation by checking polarities of starting and running windings and make final connections prior to dipping and baking the stators?—H.G.H.

ANSWER TO W40—Direction of rotation may be predetermined by checking connections to determine polarity or, you may also use a 6- or 12-volt battery or some other source of low-voltage dc, applied to the proper leads.

With dc applied to the windings you may then take a small compass and check for polarity. Rotation will be from auxiliary pole to the next adjacent main pole of the same polarity.

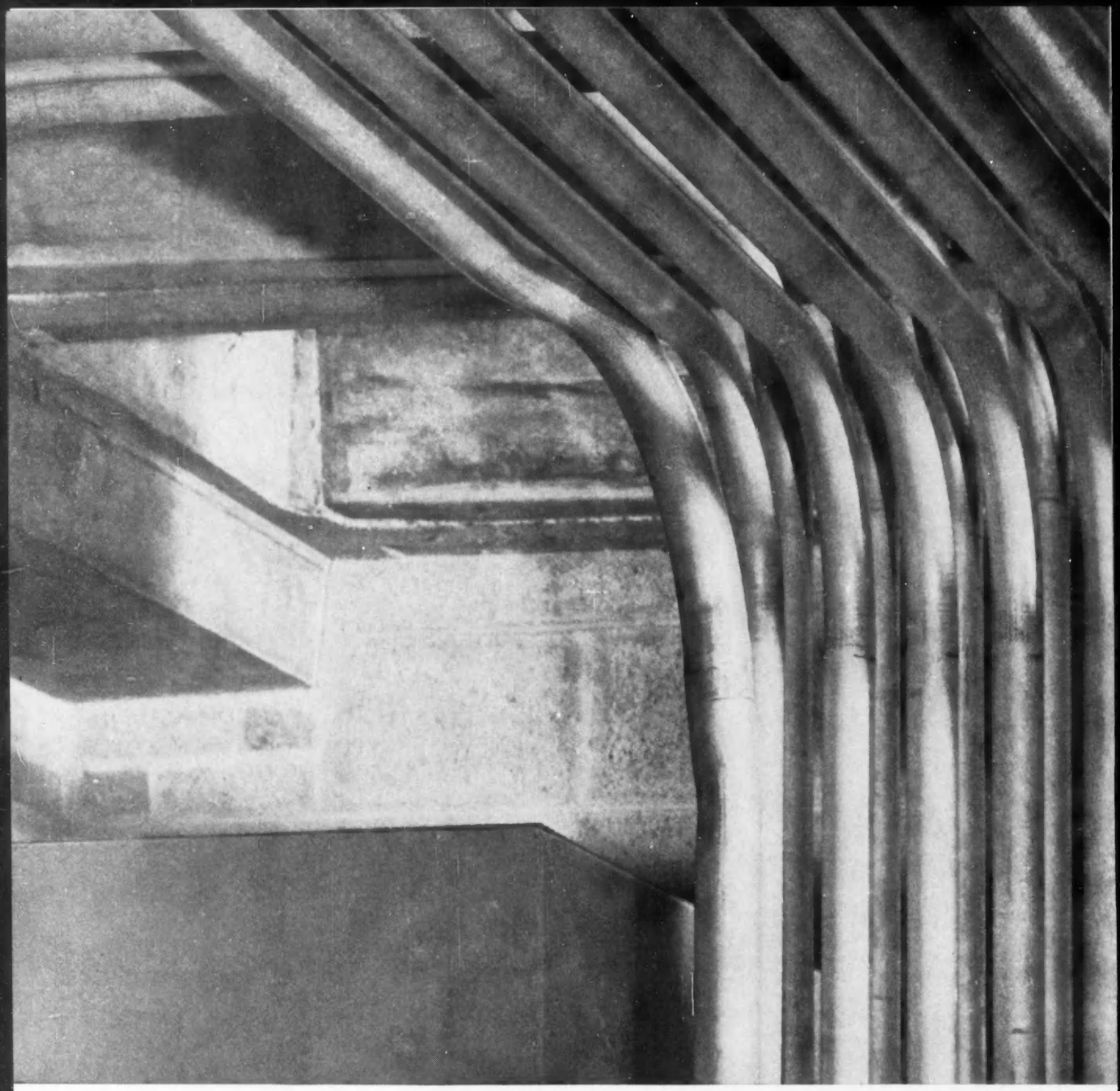
For the beginner this also is a good chance to check if adjacent main poles and adjacent auxiliary poles are of proper polarity. For the experienced winder this check is not necessary but, if you use the compass method it only takes a few seconds, and if a mistake was made it would be much easier to correct at this point.—C.E.R.

ANSWER TO W40—If a starting coil is connected so that it has the same polarity as an adjacent running coil, the rotor will turn from the starting coil toward the running coil.

The reason for this is that, when connected to the line, the current in the starting coil is at a maximum a short time before the current in the running winding is at a maximum. This means that the shifting or revolving magnetic pole produced by the combination of the starting and running winding travels from the starting winding to the running winding of the same polarity. The rotor is dragged in the direction in which the magnetism moves. To test the direction of rotation after the stator is connected, a 6-volt battery connected to the winding and a compass is held inside the stator and will show the polarity of the poles.—H.D.C.

ANSWER TO W40—There are possibly a number of methods used to determine direction of rotation of a split-phase motor. One method is by coil polarity. Direction of rotation is from starting winding coil toward running winding coil of like polarity or from the north pole of the starting winding toward the north pole of the main winding.

Another method is by the use of a testing rotor that can very easily be constructed from scraps. After windings are in place in the stator and coil groups connected, leaving only two run ends and two start ends, pair off one start and one run in two pairs, conecting test cord to these two pairs. Holding test rotor inside stator and approximately ¼ in. from laminations, momentarily plug test leads into 110-volt outlet or rated motor voltage outlet. Test rotor will turn in direction of rotation. If rotation is wrong, reverse starting leads.—A.W.L.



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Republic GALVITE®, a hot dipped Galvanized Rigid Steel Conduit, is fully protected with a bright, uniformly tight, coating inside and out. This zinc coating *stays* tight under normal bending—won't chip, flake, break, or peel. You'll like the look of the finished job you get with GALVITE.

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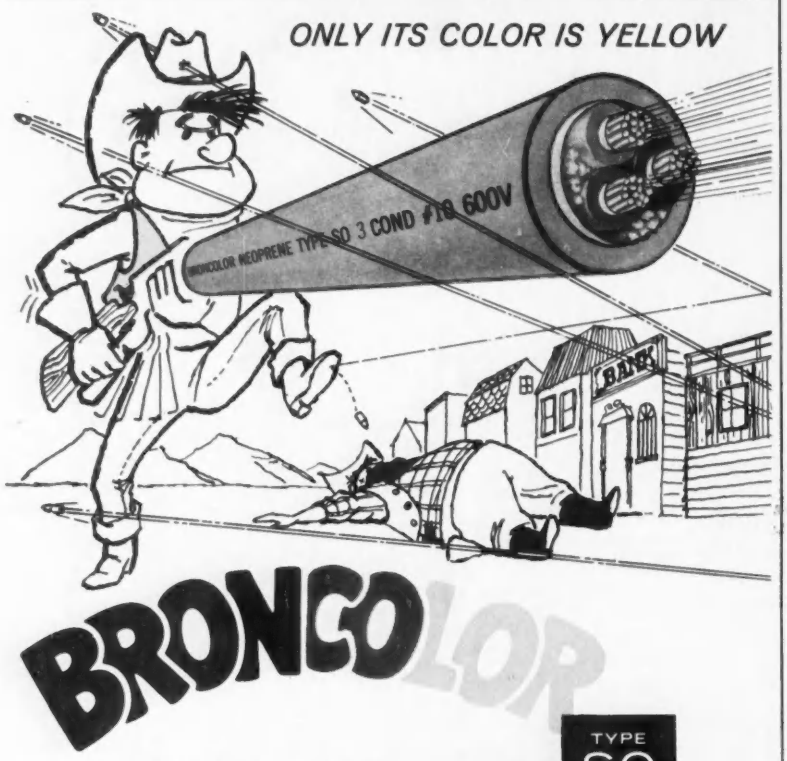
High-Visibility Heavy-Duty NEOPRENE CORDS & CABLES FROM THE BRONCO STABLES



BRONCOLOR

YELLOW NEOPRENE TYPE SO

...inside it's got all the courage and stamina bred into the Bronco line of electrical cords and cables. Broncolor Yellow supplies industry with the high-visibility, tough and flexible neoprene jacket it has long wanted. The color is bright and clear, is easily seen, prevents accidents, identifies circuits. It discourages pilfering, too. The color identifies Broncolor as company property. For complete identification, company name can be branded* into the jacket when a minimum production run is ordered. Normally "BRONCOLOR NEOPRENE," type, number of conductors, size, and rated voltage are molded* into the jacket, permanently, at precise two foot intervals. Broncolor has many advantages over other types of colored cords. For example, an overload won't melt off the neoprene jacket. At low temperatures Broncolor retains its flexibility, doesn't crack. Ozone won't break it down. And, when run through a tight packing gland, the Broncolor jacket will not "cold flow." Broncolor Yellow is compatible with several brands of patented neoprene plugs now available...can be molded. Type SO, 600 volt, and Type SJO 300 volt cords in popular sizes with 2, 3, or 4 conductors are carried in stock in a nationwide network of Bronco servicenters. All types of W, G, welding, and control cable can be made to order providing runs are long enough. Other Broncolor hues available on production run orders are green, red, blue, and gray. Whenever the best in color is mandatory, Broncolor Yellow Neoprene is first choice, an investment in continuous production.

*U.S. Patent No. 2867001

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WESTERN INSULATED WIRE COMPANY
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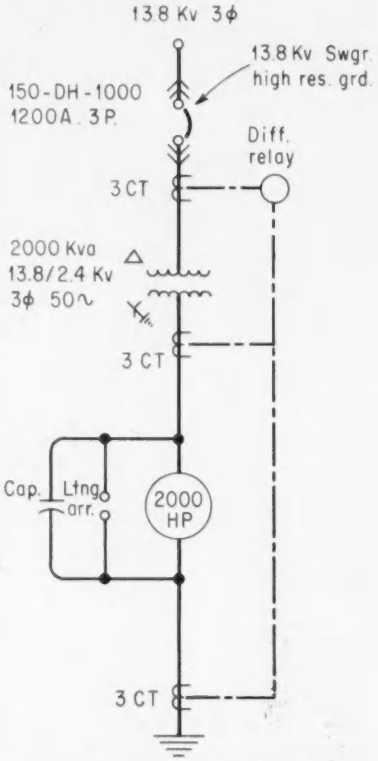
Can You Answer These QUESTIONS?

QUESTION E41—A low-impedance power transformer is used to furnish power for a 2,000-hp induction motor as shown in sketch below. A



question has been raised as to whether the neutral leads of the wye connected motor should or should not be grounded if the differential overcurrent relay is to operate properly.—V.M.M.

QUESTION F41—We are planning a dimmer control for our auditorium lights. The total load will be approximately 20 kw. We need two remote-control rheostats, one on the stage, and one at the rear door. These controls should work independently, i.e., either should completely and independently control the lights (similar to 3-way switches with variable light control). We have been told that this type control is not available.

With the present state of electrical development, this is difficult to believe. Where can such control be purchased or what we can do to make this ourselves?—J.A.M.

PLEASE SEND IN YOUR ANSWERS BY MAY 15

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UP TO 70% IN TIME

I-T-E **METERING SYSTEMS** are complete devices! I-T-E does the bussing in the factory so you don't have to wire on the job! Only two major components to connect — main disconnect and meter-breaker section. The elimination of separate wireways means faster installation and more meters in less wall space. Complete bussing also assures **lower total cost.** You merely wire in service to the main disconnect . . . and wire out distribution from the breakers.

Wall mounted meter centers are available for services through 600 Amps. Free standing island type meter centers are available for services through 2000 Amps. Installations from the smallest up to 100 **or more** meters are no problem with these superior designs.

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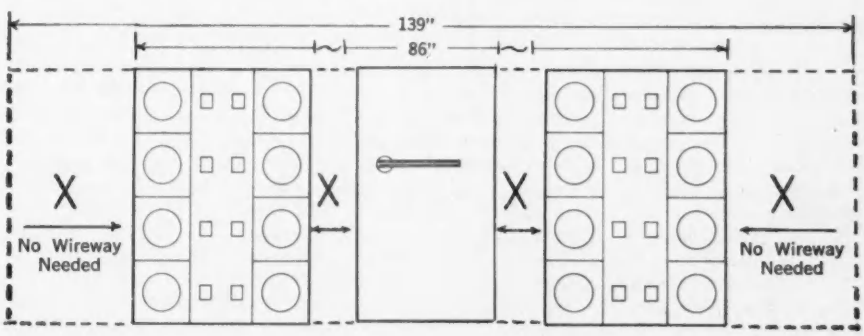
for the Contractor who is Proud of his work



I-T-E CIRCUIT BREAKER COMPANY

WALKER DIVISION

Questions on the Code

Answered by:

R. L. LLOYD, *Electrical Safety Engineer, National Bureau of Standards, Washington, D. C.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*
R. E. WARD, *Chief Electrical Inspector, Insurance Department, State of Tennessee, Nashville, Tenn.*

READERS are invited to submit questions regarding the National Electrical Code and its pratical application to this Department. Questions are answered by the consulting editor whose initials appear at the end of each item. The views and opinions expressed are, in each instance, those of the individual consultant replying and are not necessarily those of his employers, of this publication or of a Code-making committee or panel on which he may serve in an official capacity.

Grounding Service Neutrals

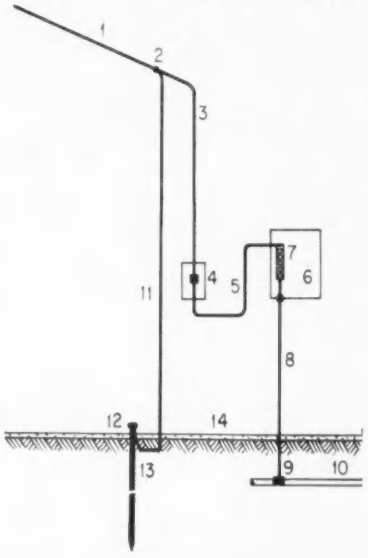
Q. *In the Proposed Amendments of the 1959 Edition of the National Electrical Code, NFPA No. 70-PR, on pages 82 and 83 a proposal is recorded to require that "where service to a building is supplied from a system having a grounded conductor, the grounded conductor shall be run to the service disconnect means and within the enclosure of the service disconnect means it shall be bonded to the equipment ground." This proposal concerns Section 250-51.*

Another proposal concerns Section 250-52, Grounding a Circuit Conductor, which states: "The grounding conductor shall be connected to the grounded circuit conductor within the enclosure of the service disconnecting means on the supply side of the service disconnect means." It is also recorded that the panel recommended the addition of a fineprint note after Section 250-52. The fineprint note would read: "It is recommended that high-capacity services have the grounding conductor connected to the grounded circuit conductor within the service-entrance equipment enclosure." Under the panel comment the following will be found: "These proposals involve a requirement that the grounding conductor be connected to the grounded circuit conductor within the enclosure of the service disconnecting means. In the majority of residential and other low-capacity services this connection is accomplished by the ordinary wiring arrangements. Some arrangements that vary from this, notably that used by the REA, appear to be satisfactory. The panel, therefore, saw no reason for a mandatory change in the code but agreed to a recommendation in the form of a fineprint note. This, together with the changes recommended in Section 250-23, is expected to accomplish the intent of the present proposals."

The panel's recommendations concerning Section 250-23 is as follows: "Where the secondary system is grounded at any point, the grounded conductor shall be run to each individual service. This conductor shall be not smaller than the required grounding conductor specified in Table 250-94(a)" with a fineprint note as follows: "The requirement for running a grounded conductor to each individual service will become effective January 1, 1964."

What method of grounding is referred to in the code panel's comments regarding residential and other low-capacity services?—F.C.

1 Neutral of service drop
2 Connection point for neutral of service drop, ground wire, and neutral of service entrance conductor
3 Service entrance neutral
4 Meter
5 Neutral from meter to service entrance equipment
6 Service entrance equipment
7 Neutral or grounding bar
8 Ground wire to water line
9 Ground clamp
10 Water line
11 Ground wire
12 Ground clamp
13 Ground rod
14 Ground level
(References Section 250-23-81-83 NEC)



A. As an example, the sketch shows a method of grounding that is widely used in Tennessee and is an example of the grounding connection such as is referred to in the above-mentioned comments. Notice that the grounding conductor running from the neutral of the service drop to the driven ground rod is attached at a point outside and ahead of the service-entrance equipment. The grounded neutral continues throughout the entire installation.

If the residence or building involved did not have a metallic water piping system meeting code requirements, grounding would be acceptable as shown. However, if a water system is available, grounding would be required as is shown in the drawing from the service equipment to the water line, or could be made at any point on the line side of the service equipment. Our State requirements are that if the water system is a home water system, or if insulating fittings such as plastic have been used, an approved supplementary ground is required in addition to the water system. In practically all cases the driven rod is the method used, and in a large majority of cases the method of connection to the driven ground is as shown. We feel this is a safety measure due to the fact that the meter reader can keep check on the connections as they are in plain view. There is also a strong belief that this method of grounding where service-entrance cable is used is a better method of grounding than if the connection is made past the service-entrance cable.

Prior to the time this method of grounding was used, we had many cases reported of ruptured service-entrance cable after electrical storms. It is seldom that we ever hear of such since changing to this method of grounding. The equipment grounding conductor would terminate in the service equipment at the grounding busbar unless the special permission rule is used. The grounding busbar is bonded to the frame.—R.E.W.

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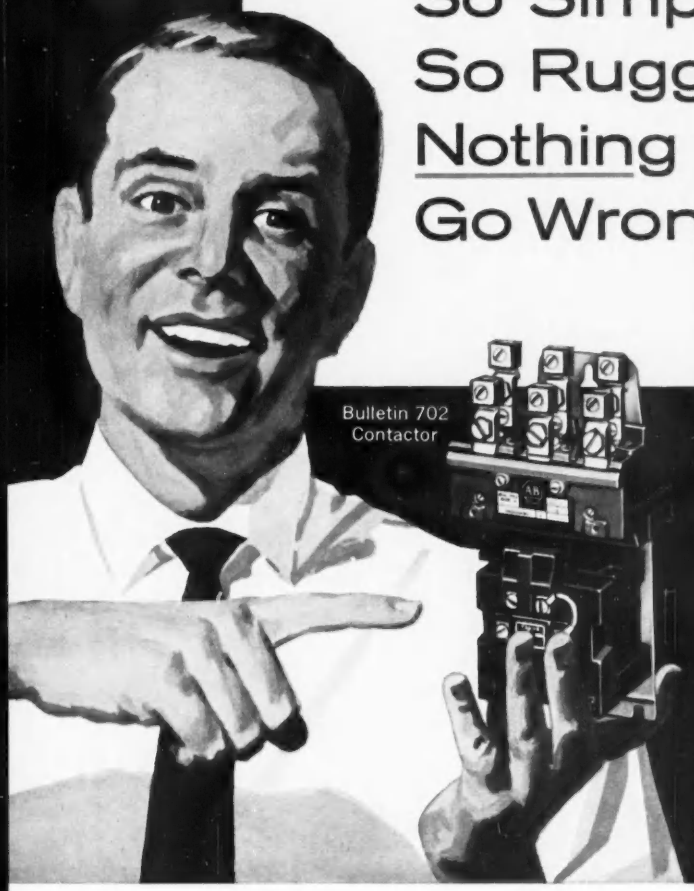
So Rugged
Nothing Can
Go Wrong!



Here are the new contactors in the Bulletin 715 Size 1 two-speed starter, equipped with a block type overload relay for each speed.

Allen-Bradley's New Contactor and Starter Design

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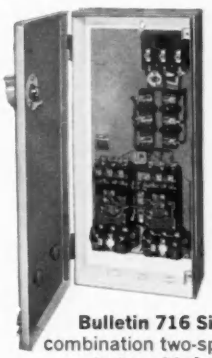
Just take a look at this design! A rugged die casting supports the entire mechanism. The new weld-resistant cadmium oxide silver contacts are enclosed—the interrupting capacity per rating is tremendous. An exclusive pressure molding process provides the coil with an "armor" against the worst possible atmospheric conditions. The patented solenoid has a built-in air gap which cannot close and result in eventual "sticking" due to residual magnetism. The new overload relays are "trip-free" and truly "tamperproof"—they're reliable no matter what the atmospheric conditions may be. What is there left to go wrong and cause trouble in the field? Nothing! And to top off the reliability of the design itself—there's a complete new family of enclosures which add definite eye appeal, as well as a closer "fit" against dust than any other make of Nema 1 enclosure.

For full details on these new Bulletin 715 starters, please write today for Publication 6100: Allen-Bradley Co., 1316 S. Second Street, Milwaukee 4, Wisconsin.



Bulletin 716 Size 1 combination two-speed starter with fusible disconnect switch in Nema Type 1 enclosure.

4-01-2

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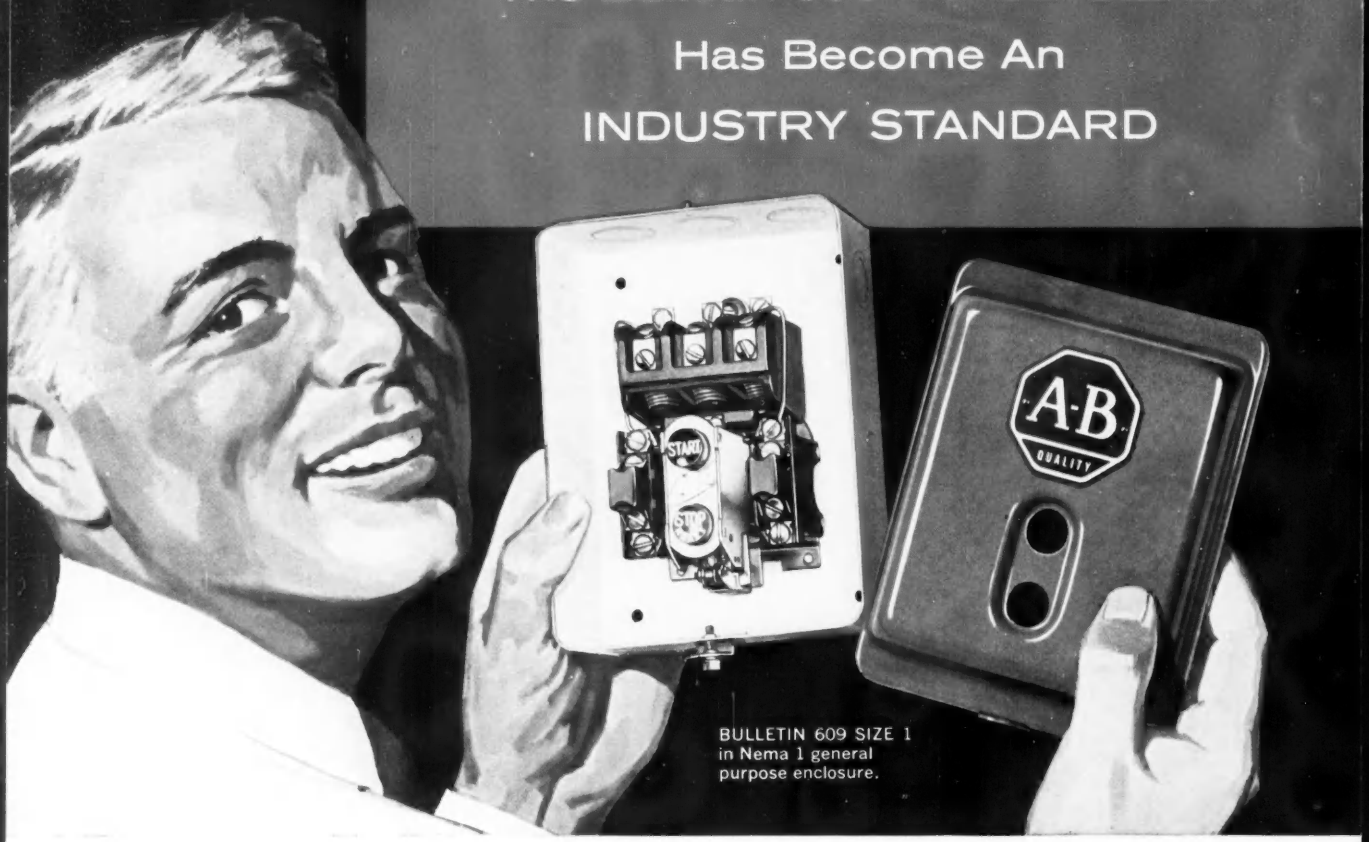
The Bulletin 609 Manual Starter Has Become An INDUSTRY STANDARD



BULLETIN 609 SIZE 1 in Nema 1 general purpose enclosure.

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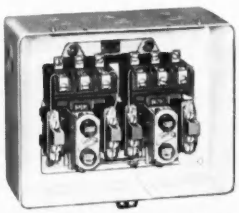
For more than 30 years, millions of these Allen-Bradley Bulletin 609 manual starters have given day-in and day-out service without trouble or maintenance.

The rugged switch mechanism provides a positive "quick-make and quick-break" snap action. Contact teasing is thus made impossible and contact life is prolonged. The double break, silver alloy contacts *never* need attention. The solderpot overload relays assure reliable and permanently accurate motor protection against burnouts. Even bad atmospheric conditions cannot affect the reliability of this protection.

Besides the attractive Nema 1 enclosure, the Bulletin 609 starting switches can be furnished in Nema Type 4 watertight, weatherproof enclosures, and Nema Type 7 enclosures for use in hazardous locations. All have a white interior—for ease in wiring in dark places.

Where manual motor control can be used, you'll get the most for your money when you ask for the A-B Bulletin 609—carried in stock by all Allen-Bradley distributors. Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wisconsin. In Canada: Allen-Bradley Canada Ltd., Galt, Ontario.



Manual Reversing and Two-Speed Starters Available in Size 0 and Size 1 Ratings. Both Bulletin 609RS (reversing) and Bulletin 609TS (two-speed) switches are mechanically interlocked. Each contactor is equipped with two overload relays.

14-0112

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EC-4-62

Conductor Identification

Q. *Do the colors specified in Section 210-5 of the NEC apply to conductors in raceways terminating at 3-way and 4-way switches?—H.R.R.*

A. Yes. The colors required for multi-wire branch circuits apply to those circuits when used to feed lights provided with 3-way and 4-way switches. On a single circuit, only one color would be concerned with respect to switching as the neutral would be carried through directly to the fixture. With all conductors in one circuit going to the switch terminals being of the same color, they can be identified by using stripes, tape marking or tags, where such additional identification may be desirable.—R.L.L.

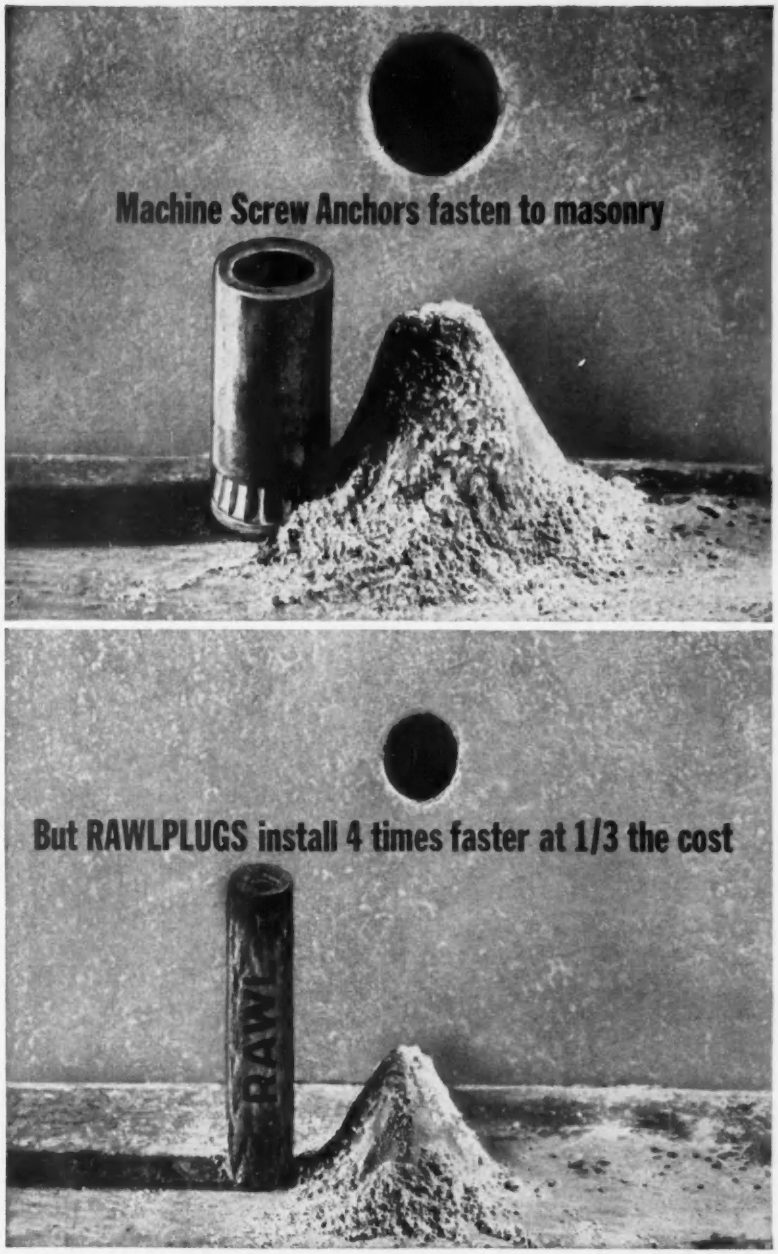
Embedding Cable Units

Q. *In Paragraph 422-35(f), the following is stated:*

"In dry board installations, the entire ceiling shall be covered with gypsum board not exceeding ½-in. thickness. The void between the upper layer of gypsum board and the surface layer of gypsum board shall be filled with thermally conducting plaster or other approved material."

In the latter part of this statement the requirement is that the void between the upper layer and surface layer of the gypsum board be filled with thermally conducting plaster or other approved material. Please give an acceptable method of filling the void with plaster material.—C.M.M.

A. In our area two methods of filling the void with plaster are used. The one most widely used, and apparently doing the best job, is for the plastering contractor to install plaster direct to the upper layer of gypsum board after the cable has been stapled in place, using the cable as the screen or guide for the thickness of the plaster installed. This assures that the cable is completely embedded before the surface layer of gypsum board is applied. Manufacturers in their instruction sheets caution against the use of insulating aggregate. Instruction sheets usually warn the plasterer not to disturb



"From a drilled hole twice the diameter of another, four times the amount of material must be removed and four times as much energy is required to remove it." A ¼ x 20 machine screw anchor requires a ½" hole, 1" deep. The same size genuine RAWLPLUG requires a ¼" hole, 1" deep. You work four times harder to drill a hole for the machine screw anchor than for the same size RAWLPLUG. In other words, you'll drill 48 holes for RAWLPLUGS in the time it takes to drill 12 holes for machine screw anchors. RAWLPLUGS save on labor. Save money, too, because the RAWLPLUG assembly (anchors, screws, drill) costs ⅓ less than the same size machine screw anchor. Full details on Rawlplugs are available in our 48-page pocket-sized "Handbook of Masonry Anchoring." Send for your free copy.

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. . . says Mr. Walter J. Powers, President

"We're more than pleased with General Electric FLEXWAY Wiring," says Mr. Powers, President, Powers Electric Co., Inc., Electrical Contractors, Providence, R. I. "This 700-foot installation we put in a new furniture store, showed us that General Electric FLEXWAY is more economical besides offering many other advantages over older surface-mounted systems . . .

New G-E FLEXWAY Wiring is grounded for extra safety, and U.L.-listed. Available with double grounding outlets rated 15A, 125V AC; 15A, 250V; or 20V, 125V AC—plus single-pole and 3-way, quiet-type switches, 15A, 120-277V AC.

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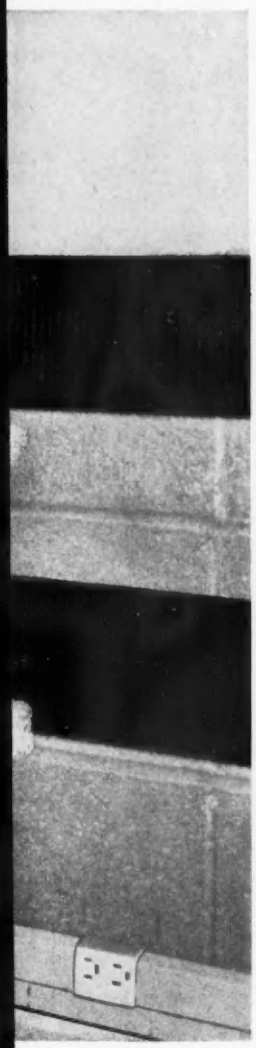
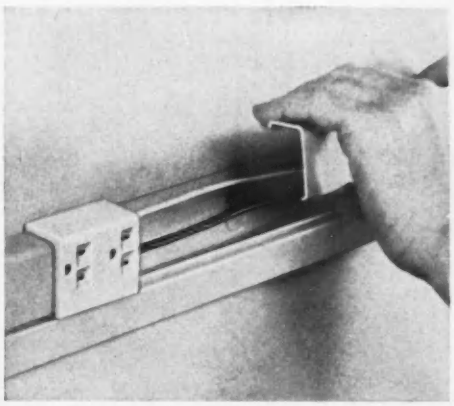
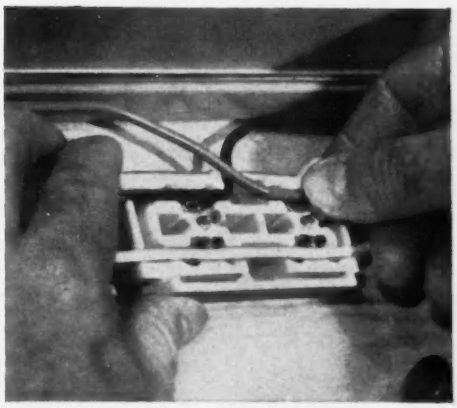
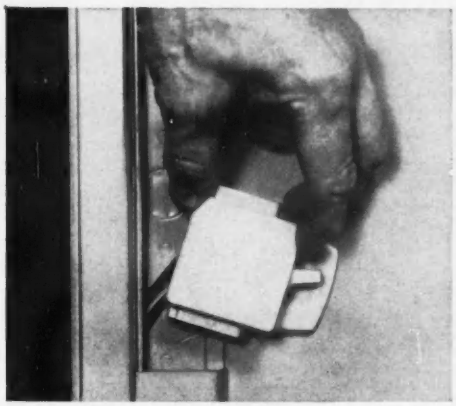




"Switches and outlets can be located anywhere, now or later, in the G-E steel raceway on any type of construction. It becomes a baseboard, door trim, or molding.



"Outlets are just pushed in wherever you want them. You don't even cut or strip the wires. Clamp-type, insulation-piercing terminals do a good job.



"Switches go in doorway trim or any place along the raceway. Covers, cut on a handy tool, close in spaces between devices and fittings, completing the system.

"Changes, additions or replacements are easy with G-E FLEXWAY Wiring. Wires can be exposed in seconds with an offset screwdriver. Covers snap tightly back in place."

*Trade-mark of General Electric Company

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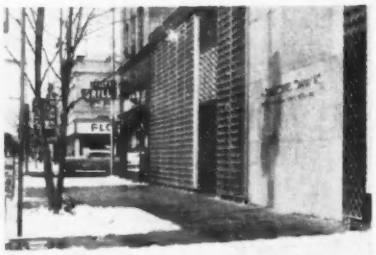
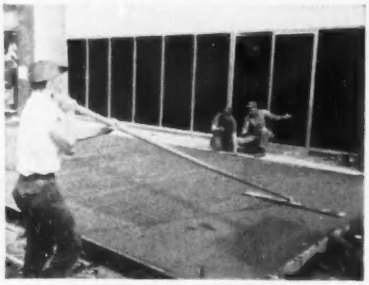
Unretouched "after" photo shows *Sno-Melter* at work in South Bend!



WINTER 1962:
Here's pictorial proof of the promise, "No more snow to shovel" on walks, drives, ramps, shipping docks which are Sno-Melter equipped! Snow-free walk in front of modern McGann Securities Co. offices, South Bend, shows where electric Sno-Melters were installed months ago.

SUMMER 1961:
Installation Was Fast!
As concrete crews poured and spread, electricians unrolled pre-assembled Sno-Melter mats right behind them.



While concrete sections were leveled, well-tagged Sno-Melter lead wires were fed into pre-arranged junction boxes. Electricians were out of way by time top 1½" of concrete was poured.

Write for engineering data, catalog.

EASY-HEAT INC.

"Electric Snow Removal Equipment"
Dept. ECM, New Carlisle, Indiana

the relative position of the cable runs and to avoid jabbing into the plaster with a trowel. Plastering is always done lengthwise with the wire in order not to disturb the position of the cable that has been installed. After plastering in the cable, the surface layer of gypsum board should be applied.

The other method is to apply non-insulating aggregate to the upper side of the surface layer of gypsum board with a notched trowel, making sure that enough aggregate is placed on the gypsum board to completely embed the cable that has been installed to the upper layer of gypsum board fastened to the ceiling. As soon as the aggregate is applied to this gypsum board, and while the aggregate is still soft, the surface layer is lifted against the ceiling forcing the plaster around the cable, and the board nailed in place. Manufacturers of this type cable, which carries a listing by UL for this purpose, will have complete instruction sheets covering installation procedures.—R.E.W.

Location of Emergency Switches

Q. *In a large school which has a combination auditorium-gymnasium with a seating capacity for* 1500 *people, the control switches for all lighting, including exit lighting, are located in a corridor adjacent to the combination auditorium-gymnasium. On more than one occasion pranksters have turned off all lights in the auditorium-gymnasium while programs are underway with large crowds attending.*

Does such location of control switches meet code requirements? —K.P.

A. No. Section 700-14 states that "Emergency illumination shall include all required exit lights and all other lights specified as necessary to provide sufficient illumination."

Section 700-18 states that "The switch or switches installed in emergency lighting circuits shall be so arranged that only authorized persons will have control of emergency lighting . . ." with certain exceptions. The exceptions mentioned in this section do not pertain to the condition as you describe it.

Section 700-19(a) states that "All manual switches for controlling emergency circuits shall be in locations convenient to authorized persons responsible for their actuation. In places of assembly such as theaters a switch for controlling emergency lighting systems shall be located in the lobby or at a place conveniently accessible thereto."

I am quite sure that some provision can be made to prevent occurrences such as you describe, and such should be made in order that the chance of panic will be minimized.—R.E.W.

Number of Receptacles per Circuit

Q. *How many receptacles may be placed on a single branch circuit in a dwelling?—W.F.G.*

A. The 15-amp receptacle in a dwelling, other than those on the appliance circuits, may be considered as an outlet for general illumination and there is no limit to the number that can be placed on a single branch circuit as indicated in the note following Table 220-2(a). Each such branch circuit is, however, required to carry its proportional share of the total load and the fineprint note in Paragraph 220-3(a) recommends a limit of 500 sq ft per branch circuit. This does not mean that a single branch circuit can feed only the area covered by a specific 500 sq ft. It is acceptable to have several circuits carried into every room in a dwelling included in the watts-per-sq-ft calculation provided the actual load (number of receptacles) is equally distributed. The minimum number of receptacles is indicated in Paragraph 210-22(b) plus those required for other loads. There is no limitation on the maximum number. The number of receptacles on each appliance circuit is also not limited in number as covered in the fineprint note at the end of Paragraph 220-2(b).—R.L.L.

Grounding Appliances in Trailers

Q. *In the NFPA Publication No.* 501*B, Standard for Fire Prevention and Fire Protection in Mobile Homes and Travel trailers, published in May* 1961 *under Item* 444, *Appliances, the following statement is made: "All factory-installed appliances shall be effectively grounded by means of an ap-*

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proved grounding-type plug or permanent wiring method. No appliances shall have their frames or enclosures connected to the neutral conductor." Following the above, the fineprint note states: "This requirement specifically disallows the permission given in the National Electrical Code for the grounding of certain appliances to the neutral conductor."

Does this mean that in the wiring for an electric range where the method of wiring is cable that it will be necessary to have a 4-conductor cable where such range requires two ungrounded conductors and a neutral conductor?—T.P.B.

A. Yes, or other approved methods of grounding may be used such as permitted in Sections 250-57 and 250-59. You will also note Item 445 of 501B states that "the neutral conductor shall not be grounded within or on the trailer." —R.E.W.

Uses of NMC Cable

Q. *Is Type NMC cable suitable for installation in the hollow spaces of an outside masonry-block wall of a building which is below grade?—T.R.S.*

A. The installation described in your question would be in accordance with the NEC provided that the NMC cable satisfies the provisions of Article 336—Non-Metallic Sheathed Cable. The permitted uses of Type NMC non-metallic sheathed cable are described in Paragraph 336-3(b) which states: "Moisture and Corrosion-Resistance Type NMC. This type of non-metallic sheathed may be installed for both exposed and concealed work in dry, moist, damp or corrosive locations, and in outside and inside walls of masonry block or tile. Where embedded in plaster or run in a shallow chase in masonry walls and covered with plaster within 2 in. of the finished surface, it shall be protected against damage from nails by a cover of corrosion-resistant coated steel at least ⅛ in. in thickness and ¾ in. wide in the chase or under the final surface finish."

Prohibited uses of Type NMC cable, as stated in Paragraph 336-3(c), are: (1) as service-entrance cable, (2) in commercial garages, (3) in theatres or assembly halls with capacities exceeding 200 persons, (4) in motion picture studios, (5) in storage battery rooms, (6) in hoistways, (7) in any hazardous location, and (8) embedded in poured cement, concrete or aggregate. Subparagraph (3) includes the pertinent code rule of Article 520 affecting uses of the cable in question.—R.L.L.

NEC Official Interpretation

NFPA's National Electrical Code Committee has released an official interpretation of a section of the current National Electrical Code. The subject of the interpretation clarifies application of Article 511 to an automotive instructional area which is part of a school building.

The official text of the interpretation follows:

INTERPRETATION NO. 472

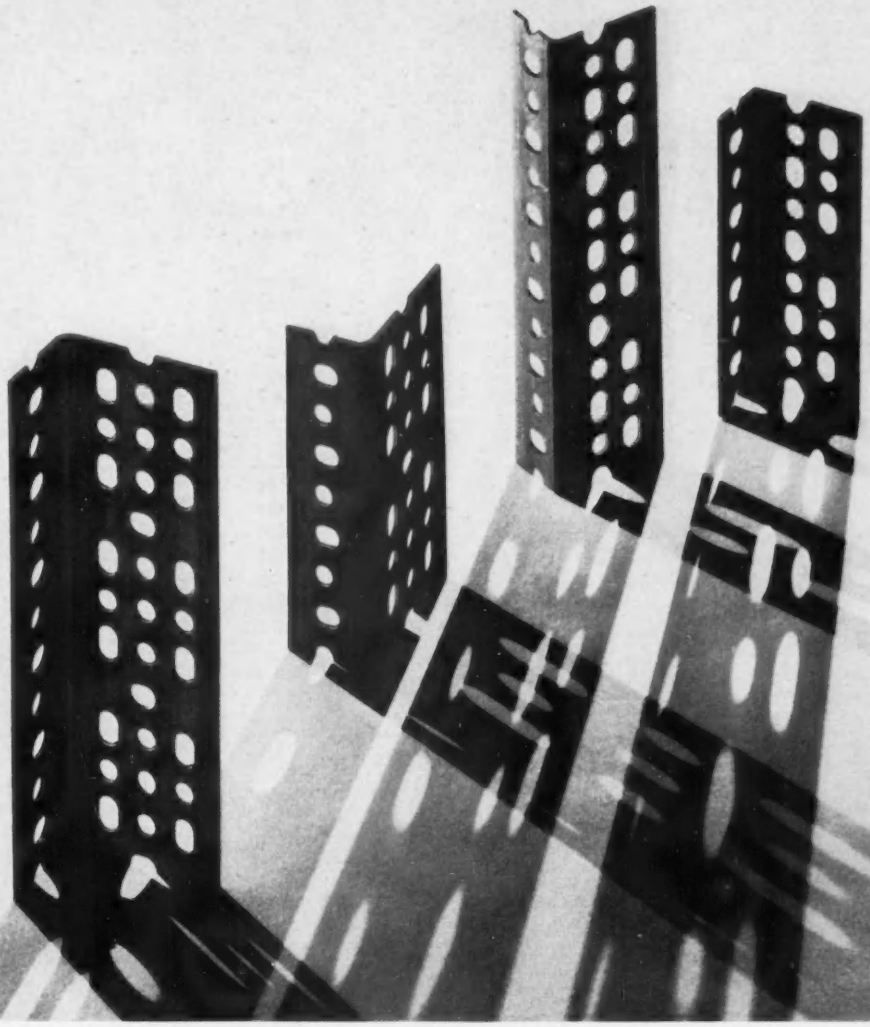
Statement: An automotive instructional area of about 600 sq ft is provided at approximately grade level as part of the industrial arts facility of a school building. The area is not cut off from the rest of the building and is provided with normal air ventilation. The area is provided with an overhead door which provides access to the outside.

A number of test stands (three to five) mount automotive engines which are disassembled, reassembled, and operated as part of the instructional process. Two complete vehicles also may be operated and/or tested in this area.

Question: Is it intended that the electric wiring and equipment of this area be subject to the requirements of Article 511?

Answer: Yes.

HONORARY MEMBERSHIP in International Association of Electrical Inspectors is conferred on Clarence A. Wingfield (right), Chicago, devoted secretary-treasurer of the Illinois Chapter. Immediate past-chairman William P. Hogan, Jr., presents certificate and gold card to him at recent 32nd annual Chapter meeting.



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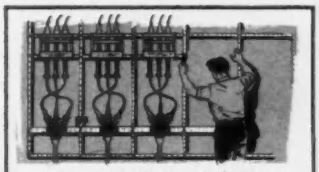

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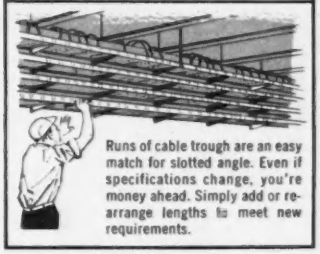

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In the News

Second Electric Heat Symposium Big Success

More than 3000 electrical industry personnel attend three days of general sessions and specialized seminars on all aspects of electric comfort heating.

THE Second Electric Comfort Heating Exposition and Symposium, sponsored by NEMA's Electric Comfort Heating Equipment Section, attracted 3171 electrical contractors, manufacturers, dealers, engineers, utility personnel, and others to Chicago's Sherman House on March 19-21.

The proceedings were designed to promote more rapid engineering and scientific progress in the application of electric heat through the delivery of technical papers, discussion groups, and commercial exhibits; to serve as an educational medium for those less familiar with the art; and to further the promotion and marketing of electric comfort heating equipment.

General chairman of the exposition was Robert D. Graham, general manager, Electric Comfort Heating Section, General Electric Co., Louisville, Ky. The equipment of more than 50 electric heating, control, and insulation manufacturers was on display, much of it indicating considerable improvement in design and performance over that exhibited during the first exposition in 1960.

In opening remarks, Stanley B. Aronson, chairman of NEMA's Electric Comfort Heating Equipment Section and sales manager of Berko Electric Mfg. Corp., Jamaica, N. Y., announced NEMA's estimate of 1.2 million electrically heated homes in the United States today, with expectations of 1.5 million by the close of 1962, 2.5 million by 1965, and 6 million by the end of this decade.

Joseph F. Miller, NEMA's managing director, urged the industry to build top-quality equipment and to create an atmosphere in which "competition will be in the direction of making the best product and thus creating a greater consumer demand."

Addressing the symposium at the industry luncheon, Donald S. Kennedy, chairman of the board and president of the Oklahoma Gas and Electric Co., discussed the generation of electric power in Russia. Although Russia's growth rate in this field has been relatively high since the end of World War II, he said, the United States is far ahead in terms of both output and capability; each year we generate more than three times the electricity produced in the Soviet Union.

Following are highlights of some of the papers presented during the 3-day symposium.

Electrical Contractors

The new sales program being developed by the National Electrical Contractors Assn. was announced by Matthew J. Sherwood, NECA's director of marketing service. The program is to provide a contractors' training course which will put the contractor in a position to offer a certified, bonded and guaranteed electric heating comfort system in a complete package sale.

Charles P. Butz, Butz Electric Co., Zion, Ill., urged contractors to attend electric heating schools conducted by their local utilities. . . . Reuben Sell, Sell Electric Co., Mission, Kan., recommended that initial sales effort be directed within the electrical industry so that the benefits of electric heat could be sold from experience. . . . G. B. Thornton, Thornton Electric Co., Niles, Mich., described his company's heating activities which increased from four installations in 1954 to an anticipated 150 complete electric heating installations in 1962, including the necessary thermal insulation in each job.

Power Supplies

Aspects of utility promotion and operating policies with respect to electric heat were outlined by more than a dozen representatives of public and private suppliers. Paul W. Emler, vice president, American Power Service Corp., New York, stated that "utilities with the lowest residential rates have, almost without exception, the highest kilowatt-hour use per customer. More electric load actually makes possible lower rates than are possible without such load and growth." He added that utility growth is brought about by adding new customers, developing existing markets, and extending service through new products and new uses. "Our failure to develop the heating market would be an admission that we are not interested in future growth."

W. L. Byrne, manager, Utility Marketing Services, Ebasco Services, Inc., New York, said that utilities are now convinced electric heat is a good load. "None of the effects that once were feared have materialized. It is beginning to do a job of balancing high summer peaks and helping to stabilize load factors

MEA OFFICERS elected at the recent annual convention of the Minnseota Electrical Association in Minneapolis include: (L to R) manager—Harry W. Kane, Minneapolis; secretary—A. O. Killmer, Osseo; treasurer—LeRoy Hauer, Little Falls; vice president—Louis Kasperek, LeSueur; advisory director at large—S. J. Berquist, Litchfield; and president—Robert DeWar, Fairmont.

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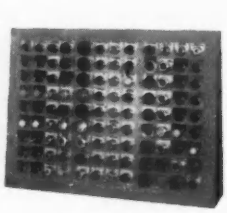

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which had slipped to precarious positions in some sections of the country. Diversity from increasing saturations is enabling distribution costs to be spread over a wider base, thus diluting fixed costs."

W. R. New, chief of TVA's Market Analysis Branch, gave information collected from TVA systems. "Summer air conditioning, together with the greater importance of major appliances that are used year-round, is now developing summer loads rapidly enough that the rates of increase in summer and winter are about the same," he said. On the average, the electrically heated home in the TVA area has 12 to 13 kw of connected load and contributes about 6 kw of demand during the summer peak. Electrically heated homes average 21,000 kwhr a year, compared with 5,500 kwhr for homes without electric heat. "Although annual load factors go down as the saturation of electric heat increases," he said, "there are many compensating factors which result in increased load growth and reduced costs, both in capital investment and in operating costs."

Guaranteed operating costs were described by Robert A. Moore, residential sales supervisor, Sacramento Municipal Utility District, Calif. He stated that the Sacramento Valley Electrical League has undertaken to pay 50% of any operating cost in excess of the estimate over an initial 3-year period. The league set up standards to insure adequacy and to aid electrical contractors in the proper design and layout of the system.

T. M. McDaniel, Jr., Southern California Edison Co., Los Angeles: It is easier to sell electric heating by the houseful as a Gold Medallion Home than to sell a home with electric heating alone. . . . Richard C. Smith, manager, Whitley County Rural Electric Membership Corp., Columbia City, Ind.: The utility must adopt standards, educate the installers and the public, and police the requirements so that both the company and the consumer are protected. . . . Ralph F. Lipps, power use director, Corn Belt Power Cooperative, Humboldt, Iowa: Our studies and controlled tests show that electric heat is the type of load we power suppliers have been waiting for. Electric heat does not add to the system peak in as high a proportion as it adds to the off-peak hours.

R. F. Plymire, vice president of sales, Pudget Sound Power & Light Co., Seattle: Our study of test homes showed that the electric com-

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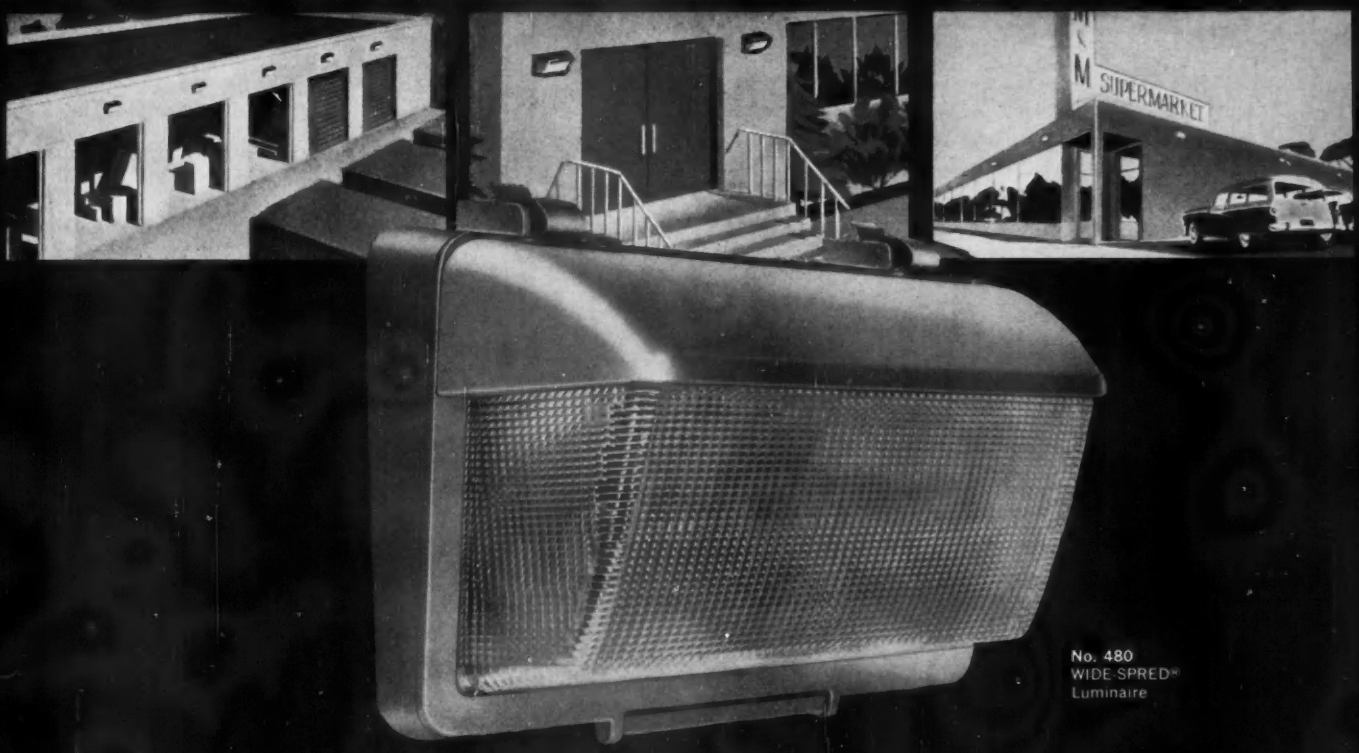

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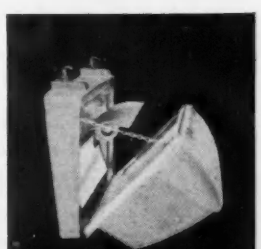

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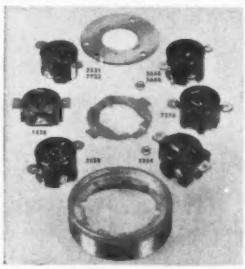

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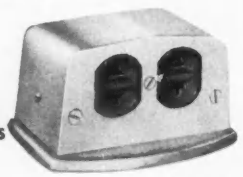

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fort heating load had no greater impact on our power costs and system capacity than the remainder of the residential load. Our average test home had 1343 sq ft, with 37% of the total installed kw representing the heating load. Of this, only about 69.5% was on at any one time in each house. Only a little more than one-third of the installed heating load appears on the system peak. Annual load factor related to system peak is substantially the same for the heating load as for the nonheating load in a representative total electric home in the Northwest.

Equipment

Types of heating equipment and controls and their use in specific heating applications received considerable attention. L. K. Stringham, vice president of research and development, Emerson Electric Mfg. Co., St. Louis, spoke on the desirability of having heating and air conditioning integrated or in two separate packages. The research man, he said, believes they should never be combined. The view of the product development man, however, is conditioned by the word "money" and whether the product will sell. The result, therefore, must be a compromise, tempered by climatic conditions.

The heat pump and its associated controls were reviewed by Ralph C. Lower and Thomas A. Lutz, both with Airtemp Div. of Chrysler Corp., Dayton, Ohio. With proper means of defrosting, they said, a heat pump can be designed to meet the heating requirements of any structure down to outdoor design temperatures as low as −10F. Heat pumps will find their greatest application where fewer restrictions are placed on the use of electric power and a minimum of complicated and unnecessary controls are required.

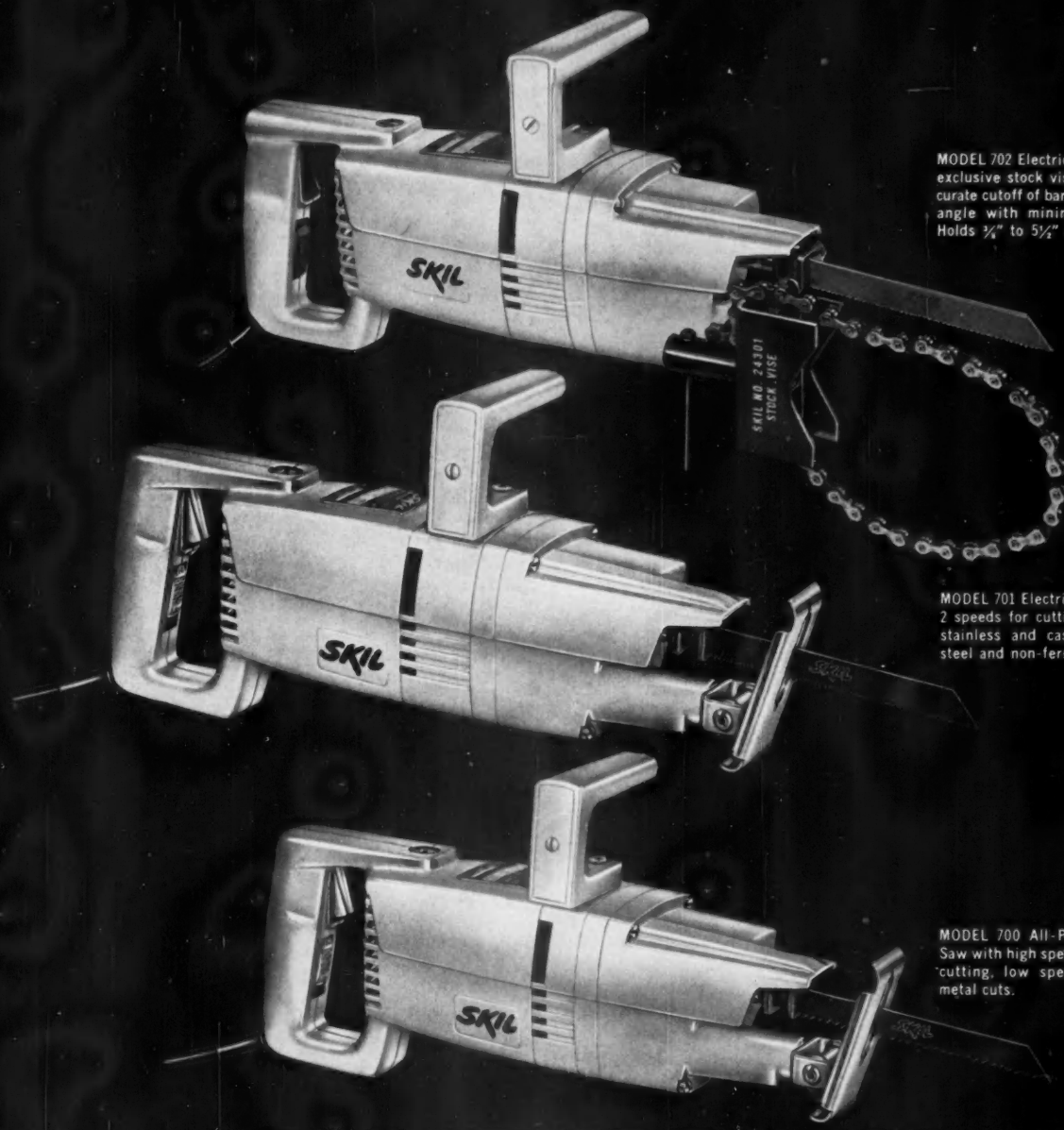
Alan Zimmerman, product manager, The Coleman Co., Inc., Wichita, Kan., described the central electric furnace as a basic building block providing controlled indoor temperature and filtered, moisture-controlled air, to which may be added complete air conditioning, electronic air cleaning, and provision for fresh air.

"Many spaces and areas that couldn't be heated practically any other way can be heated effectively and economically with infrared," said R. L. Boyd, Jr., Edwin L. Wiegand Co., Pittsburgh, who, together with W. R. Stephens, Large Lamp Dept., General Electric Co., and W. J. Novak, associate editor, *Electrical Construction and Maintenance*, outlined the theory of operation, types of energy sources, methods of control, and possible applications of infrared radiant heat. Advantages accrue from the fact that only the occupants, and not the air, need be heated for comfort with such a system, it was stated.

In discussing possible methods of heating basements, M. L. Markel, Markel Electric Products, Inc., Buffalo, suggested that finished basements be heated and insulated as the rest of the house. Intermittently occupied rooms may use convection-type equipment where the walls are finished and radiant heaters where they are uninsulated. He suggested that pilot lights be used in the main living area to indicate that basement heaters are energized where manual control is used.

Leon W. Schorr, Electrovector, Inc., Brooklyn, suggested three approaches to the heating of large glass expanses in the home. These include natural convection floor insert heaters or flush-mounted ceiling heaters directly in front of the window wall area, or a fan-forced heater on a side wall adjacent to the window area.

David Rogan, Berko Electric Mfg. Co., Jamaica, N. Y., speaking on bathroom heating, said that the housewife wants 10 to 15 degrees of extra heat readily available for quick pickup after a shower, with



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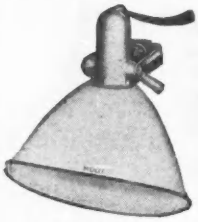

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CAT. NO. 8075 B

Send for literature on complete Multi line of Floodlights, Luminaires, Poles, Fittings, Mountings for School, Industrial, Area and Hospital lighting.

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radiant heaters usually preferred over those using forced convection.

The advantages of line- and low-voltage thermostats were described by W. A. Schmotzer, Jr., White-Rodgers Co., St. Louis, and Richard M. Locke, Minneapolis-Honeywell Regulator Co., Minneapolis, respectively. Bernard C. West, Mears Controls, Inc., Beaverton, Ore., identified methods of voltage modulation as an economic compromise between continuous control and the conventional line-voltage thermostat. Included in such systems are simple 2-stage modulation and reduced-voltage modulation. The former is essentially a 2-circuit thermostat with switches set to operate about 1½ degrees apart. The latter connects the heating load to either full or half voltage, permitting operation at half voltage over most of the control cycle.

Ventilating equipment available for the supply of fresh air and odor control was described by Edgar N. Clyde, Trade-Wind Motorfans, Inc., Pico Rivera, Calif. He explained the "square-foot" method of rating ventilators as developed by the Home Ventilation Guide. R. H. Luscombe, Penn Controls, Inc., Goshen, Ind., discussed ventilation as a means of alleviating excess relative humidity conditions, used in conjunction with automatic humidistats. He described results of a survey to determine the nature and cause of humidity complaints in electrically heated houses, together with suggestion for their correction.

Standards

Considerable emphasis was placed on progress which has been made and which is being made in upgrading all facets of the electric comfort heating program. M. B. Whitaker, vice president and chief electrical engineer, Underwriters' Laboratories, Inc., New York, described the many steps taken in the preparation of a safety standard such as UL 573, Electric Space-Heating Equipment. Listing of a heating product in this standard signifies compliance with an established level of construction and performance requirements considered necessary to safeguard against hazards.

NEMA Standards and what they mean were explained by Robert C. Cressman, manager, Commercial & Application Engineering, General Electric Co., Louisville, Ky. Unlike UL standards, those formulated by NEMA stress performance, convenience and consumer satisfaction, defining a product with reference to

COMFORT HEATING with quartz infrared tubes needs a more thorough understanding of application possibilities to capitalize on a vast market potential, Vern Heins, Luminator Co., Chicago, tells Electric Heating Forum audience at recent Upper Midwest Electrical Industry Convention in Minneapolis.

nomenclature, dimensions, ratings, safety, and operation.

W. M. Shepherd, vice president, Arkansas Power and Light Co., Little Rock, Ark., reviewed the formulation of the All-Weather Comfort Standard introduced at the 1960 NEMA exposition. He urged that the standard be adopted as a minimum operating policy, with such modifications as may be necessary to fit the climate, comfort requirements and electric rates of a specific area.

Promotion

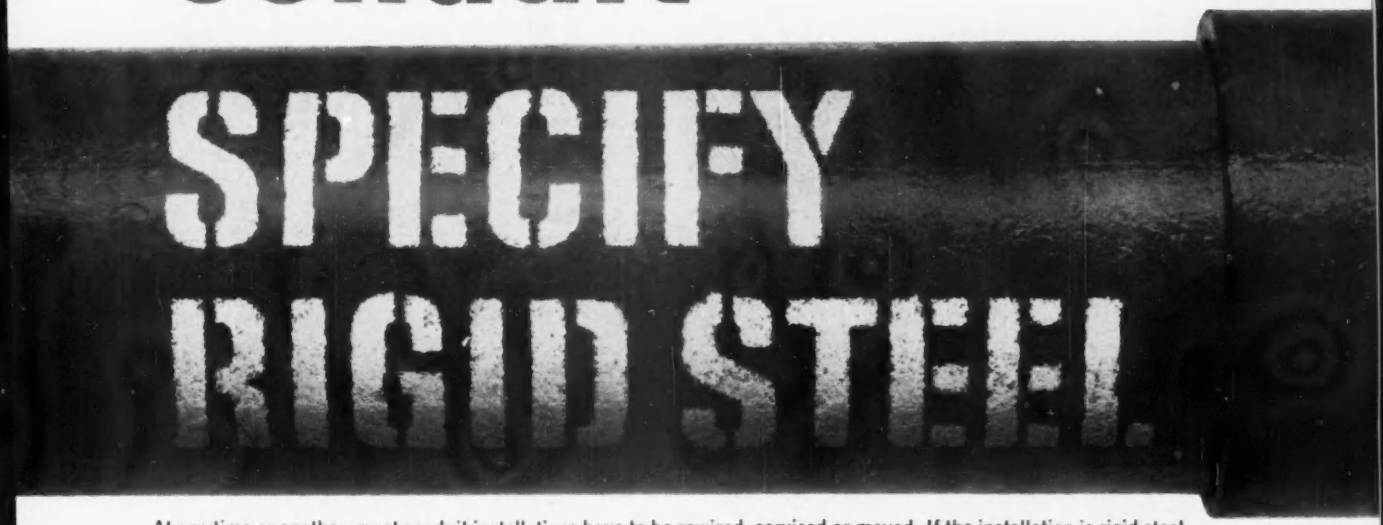
Methods of extending the use of electric heat were explored in detail. Frank Kitzmiller Jr., Edison Electric Institute, New York, said that people are willing to pay for products "provided benefits outweigh the additional cost—and cost is important only when motivation is weak. The rate of growth will be in direct ratio to the quality and quantity of advertising, publicity and other promotional efforts."

George T. Bogard, manager, Residential Market Development, General Electric Co., Louisville, stated that "any builder who does not take advantage of all the merchandising aids of the Medallion Home Program is unwittingly passing up a $50 million a year promotional program devoted to creating customer preference for electric living."

The banking industry has finally come around to giving the public what it wants—in this case electric heating. So said Donald M. Graham, Continental Illinois National Bank & Trust Co., Chicago. He em-

This mark tells you a product is made of modern, dependable Steel.

specify adaptable conduit



At one time or another, most conduit installations have to be rewired, serviced or moved. If the installation is rigid steel, many problems are eliminated. It is easy to add on to a steel conduit system; circuits can be changed or repaired quickly with a minimum of trouble. Rewiring is equally easy because rigid steel conduit has a smooth interior that makes pulling out and feeding in wire a cinch. If you have to move the system, you can take it down and put it up somewhere else with little scrap loss.

Rigid steel conduit adapts itself to any location. You can install it indoors or out, in dry or wet locations, exposed or concealed, in any hazardous location and under all types of atmospheric locations. You can bury it, or run it through or along concrete without organic covering. Steel conduit is safe. It offers positive protection because it gives a grounded metallic system, and it is strong, so it can take internal or external punishment without breaking. For strength, safety and long life, specify rigid steel conduit.

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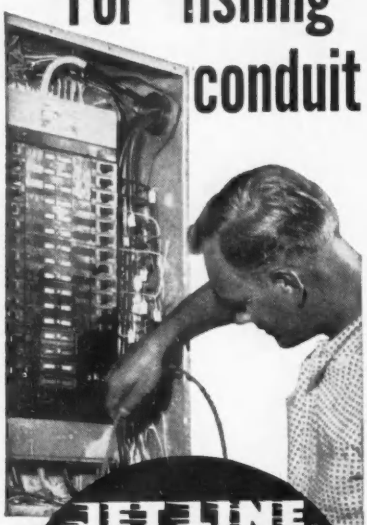
For "fishing" conduit



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5916

phasized that lending agencies must look closely at insulation specifications and their compliance so that heating costs will not be substantially different from estimates which would, in turn, cause financial hardships on the homeowner.

Insulation

All currently used types of thermal insulation were discussed, together with instructions as to their correct application. R. N. Kennedy, Dow Chemical Co., covered plastic foams. Fred H. Sides, National Mineral Wool Insulation Assn., demonstrated the use of batts and blankets. O. J. Fish, Pal-O-Pak Insulation Co., Inc., described the use of blown-in insulation in existing structures.

Gordon Erickson, Wood Conversion Co., reported the latest findings of research being conducted in two electrically heated test houses in Minnesota by his company.

Art Johnson, National Mineral Wool Insulation architect, described a simplified method of calculating heat loss and estimating operating costs for electrically heated structures which are insulated to R-values designed to produce compliance with the All-Weather Comfort Standard. The graphical method involved eliminates calculations and speeds the process considerably.

Illinois Inspectors Hear New Conduit-Fill Report

Inspectors, engineers and contractors attending the 32nd Annual Meeting of the Illinois Chapter, IAEI, at Chicago's Hotel Morrison, learned that electrical conductors run hotter in larger conduits than in smaller ones. And conductor temperatures vary with the type and color of conduit in which they are enclosed. That was the gist of a preliminary report presented during the code problems session of the two-day conference held in February. Its implications generated considerable interest among those present.

Floor discussion was initiated by Wm. P. Hogan, Jr., chief electrical inspector, City of Chicago, and member of Code-Making Panel No. 6. Mr. Hogan revealed that additional inquiry into the relationship between conductor temperature rise and conduit fill was a by-product of routine Underwriters Laboratories' tests of the new Type THWN conductors. Results of the limited conduit-fill investigation by UL were covered in a report by Vincent McBride, Lebanon, Conn., formerly chief engineer of the Plastic Wire and Cable Corporation and now a consulting engineer.

McBride's report, supplemented by graphs and charts, revealed the following test results and facts:

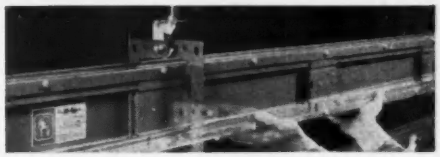
1. Dead air space surrounding conductors in conduits creates a thermal insulating blanket retaining heat around the conductors. The greater this air space, the thicker this blanket becomes with a resultant increase in temperature rise. Thus, the same number and size conductors, with the same ampere loading, run hotter in larger conduits (smaller percent fill) than in smaller ones (larger percent fill). As much as 40% spread in temperature rise was noted.

2. The color of the interior surface of conduits has a definite effect on conductor temperature rise. Bright surfaces reflect more heat back into the air space surrounding the conductors. Using the same number and size conductors, with same ampere loading, in same size conduits with different interior surfaces, the tests showed an increase of 40% between the highest and lowest recorded conductor temperatures. The temperature rise was highest in uncoated aluminum and bright galvanized steel conduit; lowest in black enameled conduit.

Both Hogan and McBride agreed that these limited tests open a field for a more intensive investigation of this subject. Delegates concurred by unanimously passing a formal motion requesting that the appropriate Code-Making Panel of the NFPA Electrical Correlating Committee be asked to instigate a full investigation with a view to developing a comprehensive fact-finding report.

At the formal technical educational sessions, E. C. Soares, Pringle Electrical Manufacturing Co., discussed effective grounding techniques as a means to assured safety. R. A. Nelson, Simplex Wire and Cable Co., reviewed latest developments in wire and cable insulations; and the Greater Chicago Safety Council presented a film on the hazards and control of static electricity. Larry Mangione, Electric Supply Corp., Chicago, pointed out that electrical inspectors, unhampered by competitive pressures, can do an effective job of promoting the upgrading of electrical installations above mere safety standards.

Leland J. Hall, electrical inspector, Orland Park, Ill., was elected



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chairman of the Illinois Chapter, IAEI, at the business session. Other officers elected on the same slate include: 1st vice chairman—Edward J. Boyle, Chicago; 2nd vice chairman, Randall L. Beasley, Mattoon, Ill.; 3rd vice chairman—Joseph H. Green, Chicago. Clarence A. Wingfield, Chicago, was re-elected secretary-treasurer.

N. Y. Show Attracts 23,000

The 6th National Electrical Industries Show, held March 11 to 14 in New York's Coliseum, was visited by over 23,000 electrical industry people. More than 300 exhibitors participated.

Attendance included electrical distributors, electrical contractors, electricians, electrical maintenance men, electrical engineers, architects, builders and other members of the electrical industry and its allied fields.

One interesting spectator group consisted of 15 electrical wholesalers from West Germany. They will also visit other cities throughout the U. S. before returning to Germany.

The show was sponsored by the Eastern Electrical Wholesalers Association, and was the sixth such show to be held in the postwar years.

EASA News

An independent electric motor repair shop in New York recently gave a demonstration of the kind of service that EASA members like to believe is typical of the manner in which they operate in emergencies. The job involved a burned-out motor on an air-conditioning unit at Abilities, Inc., a firm consisting of occupationally handicapped workers. Flushing Electric Corp. was called in to service the unit which had broken down during a blistering heat wave.

Unfortunately the motor had been made on special order for the air-conditioning firm. Its manufacturer said it would take four weeks to deliver the stator core that needed to be replaced. Standing in the sweltering factory watching 350 blind, deaf or crippled workers courageously going about their jobs, Flushing Electric's Ralph Mollet made his decision and went to work.

It wasn't easy. A number of slots were a mass of fused copper and

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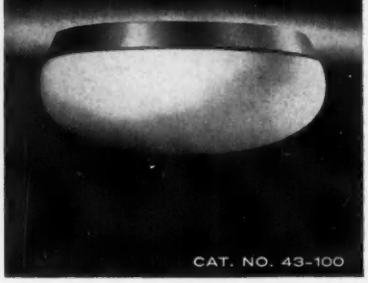

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• **enclosed and gasketed** . . . for exterior weathertight, vaportight, bug tight operation • **everlasting cast aluminum construction** . . . high stress alloy, ⅛" min. wall thickness, corrosion resistant • **satin anodized finish** . . . for permanent beauty • **glareless** white shallow globe • available with **one-piece hinged guard** . . . designer styled, functional: dimensions . . . globe dia: 12½", depth: 5"

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This smart little machine weighs only six pounds, yet does just about everything the big, expensive machines do...and a couple of things they can't.

The big machines add, subtract, multiply, divide.

So does the Bohn Contex.

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They can't double as high-speed 10-key adding-subtracting machines.

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To a businessman who pays $500 to $1,000 for an office calculator, the price of our Brainchild seems too good to be true. Our suggestion: *borrow a Bohn Contex and see how it figures to save you money*. Any dealer listed below will lend you a hand (or electric) model. If the dealer in your city is not listed, or you're not in a borrowing mood, just mail the coupon.

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(when other ballasts are only guaranteed for one?)

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iron. After the old winding was stripped out, there was the tedious job of grinding out the fused metal. It took 22 grinding wheels and 14 hours to clean up the mess. The rest was a routine rewind, and the repaired motor was in service less than a week later.

Mr. Mollet is president of EASA's New York Metropolitan Chapter.

• • • •

The first of EASA's new advanced Electronic Motor Control Course, held March 12-14 in New York City, was a sell-out. Four more three-day courses are to be conducted this spring—in Chicago, April 9-11; in Atlanta, April 23-25; in Dallas, May 7-9; and in San Francisco, May 21-23.

• • • •

Rectifiers can be used for economy's sake, Ralph O. Kufen, vice-chairman of EASA's Engineering Advisory & Educational Committee, stated recently.

Shop owners will find that in most cases it is more economical to them and to their customers to use a rectifier rather than rewind a motor-generator set, Mr. Kufen, who is president of Kufen Electric Motors Inc., stated.

It is not advisable to control the direct current output of a rectifier with resistance, but, rather, it is preferable to control the alternating current input to the rectifier, Mr. Kufen noted.

He suggested using a variable transformer and a full-wave bridge rectifier for direct current source. Both, of course, should be of the proper voltage and current.

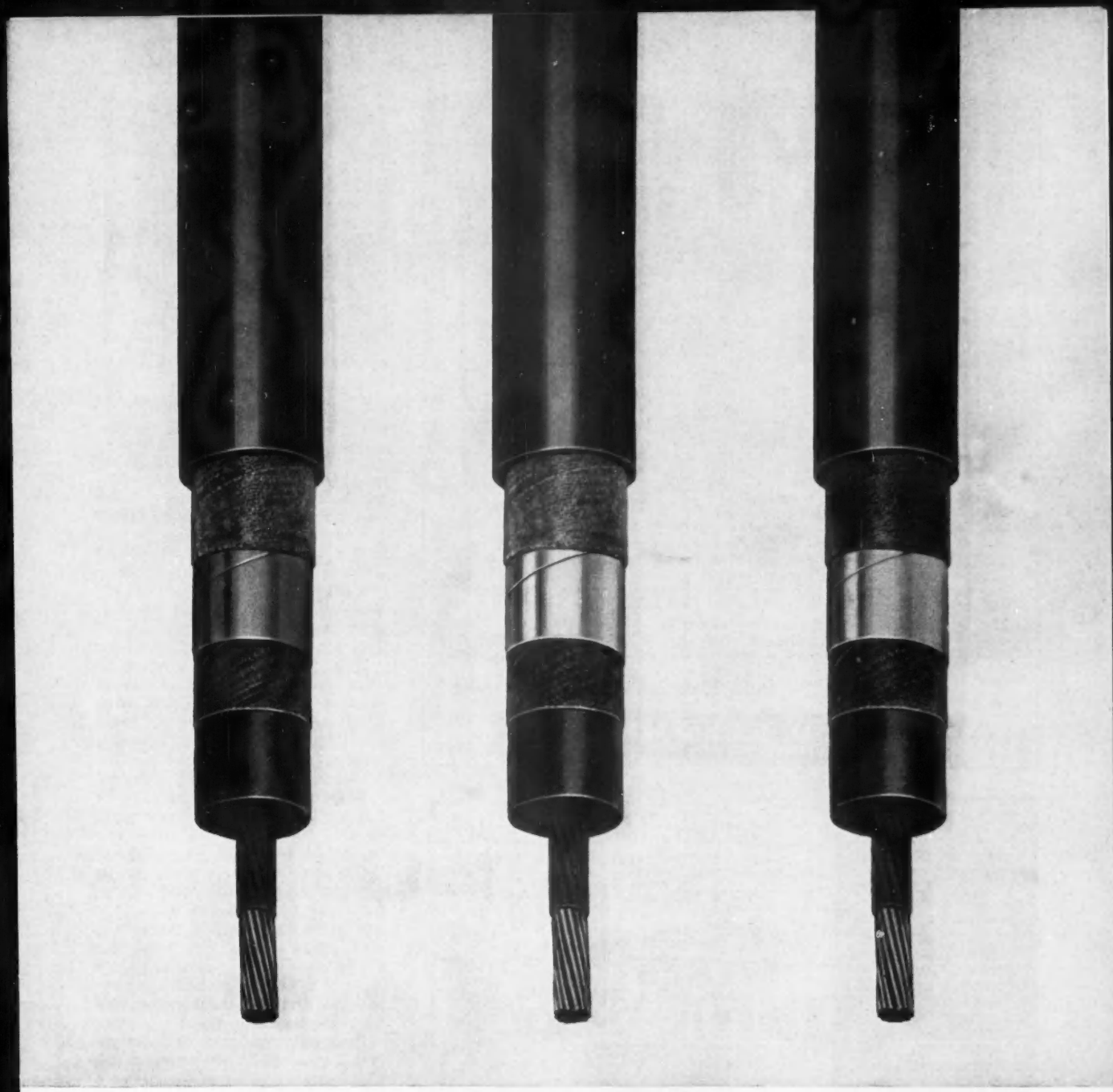
"Rectifiers make nice portable testing units, too," he added.

• • • •

Skiers on Vermont's Stratton Mountain probably won't know it, but the three double chair lifts that now take them to the top of the run were installed by an independent motor service firm, Electric Motor Repair Co., Springfield, Mass. The equipment includes three dry type transformers, motors and controls—a 300-kva 480/208 unit in the main lodge of the resort, and 500 and 750-kva pad-mounted units which supply power to the 50, 125 and 200-hp/wound-rotor lift drive motors. The wound-rotor design was specified because of the varying loads and speeds.

• • • •

EASA President George Larsen, of Larsen-Hogue Electric Co., Los Angeles, Calif., has been busy on the association's chapter circuit. His itinerary includes visits this



Which one is the Circle cable?

It's the one in the middle. But, don't feel too badly if you guessed wrong. To the naked eye there is no apparent difference. Most power cables look alike. The big difference in Circle cable lies in the extra care taken in its manufacture... in the high quality of the materials of construction... and particularly in the stringent tests it undergoes to assure that it meets every rigid specification.

You'll notice the difference in the service you get from Circle power cable. On your next job be sure to specify Circle cable—there is no finer cable made.

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PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES & WAREHOUSES:** In all principal cities.
Rubber Covered Wires & Cables • Varnished Cambric Cables • Plastic Insulated Cables • Neoprene Sheathed Cables • "CIRTUBE" EMT

There's An Easier Way!

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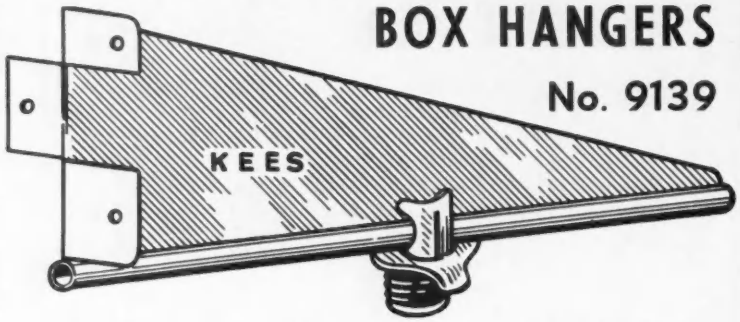

Inexpensive, yet easier and quicker to install . . . completely adjustable . . . and they're now made of heavy pressed galvanized steel with cadmium plated wing nuts and studs.

They can be used to mount any type of box and fixture from any type of ceiling, using any type of wiring, in new or old construction. Attached to the side of a joist or rafter with three nails or screws, the bracket supports more than 70 pounds suspended from the extreme end.

The bracket is 10 inches long, 3 inches high at the nailing end. The lower edge is formed into a ⅜" tube on which the fixture stud slides. Stud can be positioned exactly. Each bracket furnished complete with stud and oversized wing nuts.

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AT THE EASA exhibit at the Plant Engineering & Maintenance Show in Philadelphia, January 22-25, at Convention Hall: from left—Charles J. Sheridan, Brownell, Inc., Philadelphia; Milton Eisenhardt, operator of a motor shop under his own name in Pennsauken, N. J.; and George McDaniels, partner, and Bruce Bender, superintendent, Kufen Electric Motors, Warminster, Pa.

spring to EASA's Chicago, Great Lakes, Heart of America, Midwestern, Mid-Atlantic, Mid-South, New England, Quaker City and Wisconsin chapters.

• • • •

Two twenty-fifth anniversaries were celebrated recently by EASA member companies: Piedmont Electric Repair, High Point, N. C., and Pixler Electric Corp., Spencer, Iowa.

• • • •

The successful small business is the one that works "smarter not harder," notes EASA president George Larsen.

Commenting that many large service shops are equipped to perform efficiently on the units that come into their shops repeatedly, Mr. Larsen pointed out that management should devote more thought to the unusual jobs so they will be prepared to handle them when the occasions arise.

He recalled an example of an operation that had to be repeated 260 times in the course of repairing a large motor. At first each operation was taking 30 minutes, obviously too long. "With a little thought a new way to do the job was discovered, reducing the time to *two* minutes," Mr. Larsen said. "This is an example of working smarter not harder."

• • • •

More than 50 exhibit spaces have been sold for the 29th Annual EASA Convention to be held in Chicago June 10-13 at the Conrad Hilton Hotel. Firms having already contracted for space include eight motor manufacturers, seven insulation manufacturers, three manufacturers of shop equipment, three supply houses, and a number

of companies manufacturing controls, testing units, carbon brushes, and miscellaneous products.

• • • •

Burton A. Hannewald, Scherer Electric Co., Indianapolis, Ind., was honored by the association as "EASAN of the Month" for March. The 61-year-old general manager and treasurer is a native of Brooklyn where he graduated from Polytechnic Institute in 1922. He joined his present firm in 1948, and is secretary of the Indiana Chapter.

• • • •

Business conditions generally are good in the electrical service industry, reports indicate, with a few exceptions. In California, EASA's Orville Stump, Los Angeles, and Al Kinney, Marysville, reported that all shops are busy. In New England, Bob O'Day, Boston, says that new, diversified industries are replacing the lost textile mills, creating new challenges to the motor shops who are keeping pace with the changing economy. In the Midwest conditions are good according to Julian Hupp, Cedar Rapids, Iowa, and Bob Langhirt, Columbus, Ohio, to name two. In the Northwest, Eldon Strom, Troy, Idaho, predicts an improvement in conditions this year, noting that 1961 was up at least 10% in sales. In Texas, Paul Bush, EASA director from Lubbock, reports that recent cold weather in the southern part of the state has severely hurt agricultural areas, in some cases a year's crops having been lost.

• • • •

A popular member of EASA's Quaker City Chapter, Harry M. Rezer, president, Electrical Maintenance Equipment Co., Philadelphia, was prominent in the recent Electrical Insulation Conference in Washington, D. C. Mr. Rezer was chairman of the Marketing meeting and dinner.

JOHN F. EHLERS, Electric Motor Supply Co., Baltimore, Md., and EASA president George Larsen, Larsen-Hogue Electric Co., Los Angeles, Calif., at the Electrical Insulation Conference, Washington, D. C. last February 19-22.

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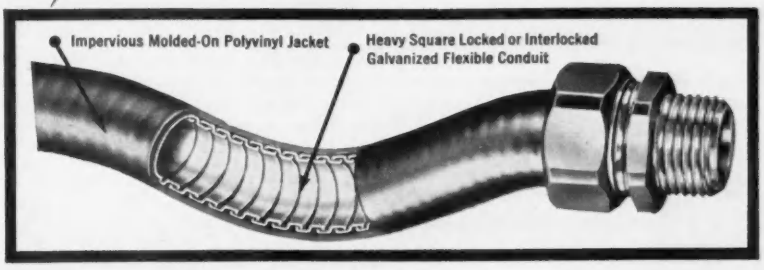

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DATES AHEAD

Illuminating Engineering Society—Regional Conferences — **Southeastern/South Central,** King Edwards Hotel, Jackson, Miss., April 12-13; **Great Lakes,** Dayton Biltmore Hotel, Dayton, Ohio., April 16-17; **Midwest/North Central,** Radisson Hotel, Minneapolis, Minn., May 10-11; **Canadian,** Winnipeg, Man., May 14-15; **Pacific Northwest,** Davenport Hotel, Spokane, Wash., May 17-18; **South Pacific Coast,** U. S. Grant Hotel, San Diego, Cal., May 21-22; **Inter-Mountain,** Western Skies Hotel, Albuquerque, N. M., May 24-25; **Maritime,** Charlottetown Hotel, Charlottetown, P. E. I., June 8-9; **Northeastern,** Hotel U. S. Thayer, West Point, N. Y., June 11-12.

Rocky Mountain Electrical League—Spring conference, Harvest House, Boulder, Colo., April 15-17; Fall convention, The Broadmoor, Colorado Springs, Colorado, October 14-18.

International Association of Electrical Inspectors — Chapter Meetings — **South Carolina,** Andrew Jackson Hotel, Rock Hill, S. C., April 16-17; **Georgia,** Wanderer Motel, Brunswick, Ga., April 19-20; **Alabama,** Stafford Hotel, Tuscaloosa, Ala., April 23-24; **Five Chapter Joint Meeting,** Captain Shreve Hotel, Shreveport, La., April 26-28; **Tennessee,** Andrew Jackson Hotel, Nashville, Tenn., April 30-May 1; **Florida,** Jack Tar Harrison Hotel, Clearwater, Fla., May 4-5; **Utah,** Newhouse Hotel, Salt Lake City, Utah, May 7; **Virginia,** Hotel John Marshall, Richmond, Va., June 18-19; **Southern Section,** Tutwiler Hotel, Birmingham, Ala., October 15-17.

UNLESS ELECTRICAL contractors learn design, installation and equipment selection, other agencies will take over the electric heating field warns William N. Collins, Collins Electrical Construction Co., St. Paul, Minn. Contractors should know how to engineer a job, he told an Electric Heating Forum session at recent Upper Midwest Electrical Industry Convention in Minneapolis.

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Building Research Institute — Spring conference, Shoreham Hotel, Washington, D. C., April 23-26; Fall conference, Mayflower Hotel, Washington, D. C., November 27-29.

Chamber of Commerce of the United States — Annual meeting, Sheraton Park Hotel, Washington, D. C., April 29-May 2.

National Association of Electrical Distributors — Convention, Pittsburgh, Pa., May 12-16.

Pacific Coast Electrical Assn.—Annual convention, Ambassador Hotel, Los Angeles, Calif., May 16-18.

National Fire Protection Association—66th annual meeting, Sheraton Hotel, Philadelphia, Pa., May 21-25.

Edison Electric Institute—Annual convention, Atlantic City, N. J., June 4-6.

Electrical Apparatus Service Association—Convention, Conrad-Hilton Hotel, Chicago, Ill., June 10-13.

National Society of Professional Engineers—Annual meeting, French Lick Sheraton Hotel, French Lick, Ind., June 13-16.

Los Angeles Home Show — Memorial Sports Arena, Los Angeles, Calif., June 21-July 1.

American Society of Heating, Refrigeration & Air Conditioning Engineers Inc.—69th annual meeting, Deauville Hotel, Miami Beach, Fla., June 25-27.

N. Y. State Assn. of Electrical Contractors & Dealers—Annual convention, Whiteface Inn., Lake Placid, N. Y., July 2-7.

Western Electronic Show & Convention — Memorial Sports Arena, Los Angeles, Calif., August 21-24.

American Home Lighting Fixture Month—National promotion, September 1-30.

Illuminating Engineering Society—National technical conference, Statler-Hilton Hotel, Dallas, Texas, September 9-14.

Canadian Electrical Mfrs. Assn.—Annual meeting, Sheraton-Brock Hotel, Niagara Falls, Ont., October 3-5.

International Assn. of Electrical Leagues — 27th annual conference, Sheraton-Chicago, Chicago, Ill., October 3-5.

National Electrical Contractors Assn. —Minneapolis Auditorium, Minneapolis, Minn., October 7-13.

National Electronics Conference—Mc Cormick Place, Chicago, Ill., October 8-10.

Electrical Manufacturers Trade Show —Indiana State Fair Grounds, Indianapolis, Ind., October 23-25.

National Electrical Manufacturers Assn.—Annual meeting Shoreham Hotel, Washington, D. C., week of November 12.

GETTING ACQUAINTED at recent Upper Midwest Electrical Industry convention in Minneapolis, are electrical contractors Bob Dillon (left), Pelican Rapids, Minn., and MEA director Ed Langlie, Thief River Falls, Minnesota.

Among the Manufacturers

Headquarters Announcements

Burndy Corp., Norwalk, Conn.—Marvin Lee, president and director of Burndy, has been elected also president of **Husky Products, Inc.,** Cincinnati, Ohio, a division of Burndy. Jerome Franks, general manager of the division, has been named vice president.

Westinghouse Electric Corp., Bloomfield, N. J.—L. J. Fitzpatrick, manager, Large Lamp Dept., Lamp Div.

Thomas Industries, Inc., Louisville, Ky.—E. Allen Lea, manager of distribution sales of all lighting products; Michael N. Flynn, manager, architectural products; Arthur A. Swedenborg, manager, project sales with headquarters in Des Plaines, Ill.; Vern L. Winn, manager, specialty sales.

General Electric Co., Schenectady, N. Y.—Dr. Henry H. Marvin, manager of engineering, Capacitor Dept.

Triangle Electric Co., Detroit, Mich. — J. W. Albright, Jr. and Donald A. McFadden, vice presidents.

Dayco Corp., Dayton, Ohio — Robert B. Jacob, president.

United Electric Controls Co., Watertown, Mass. — George W. Clapp, vice president.

Owatonna Tool Co., Owatonna, Minn.—R. W. Kaplan, president; A. R. Kaplan, vice-chairman of the board; James F. Senrick, sales manager of Precision Hydraulics Div.

Line Materials Industries, Milwaukee, Wis.—R. Keith, product manager, protective equipment and capacitors.

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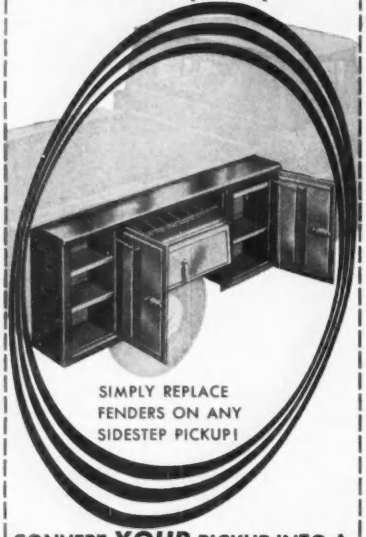

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Electric Autolite Co., Toledo, Ohio—Edwin J. Wilczynski, sales office manager, Industrial Sales Div.

Penn-Union Electric Corp., Erie, Pa.—Lester R. Crane, vice president and general manager.

Wheatland Electric Products Co., Carnegie, Pa. — Frederick J. O'Reilly, executive vice president.

General Electric Co., Waterford, N. Y.—Dr. Hart K. Lichtenwalner, manager of Process Development Unit, Silicone Products Dept.

Champion Lamp Works, Lynn, Mass.—Robert A. McCully, manager, Commercial Engineering Dept.

Keystone Mfg. Co., Warren, Mich. — Leonard E. VanDuyne, general sales manager.

Bryant Electric Co., Bridgeport, Conn.—H. E. Robertson, marketing manager; George R. Conover, sales manager for wiring devices; A. W. Larson, national accounts sales manager.

Sylvania Electric Products Inc., New York, N. Y. — Merle W. Kremer, senior vice president, Electronic Tube and Parts Div., Emporium, Pa.; Donald C. Thomas, application engineer for fixtures, Lighting Products Div., Wheeling, W. Va.; Alton C. Kendall, vice president of fixture operations; John W. Newton, Jr., public relations manager and Charles R. Powell, national sales engineer for sign tubing—all with the Lighting Products Div., Salem, Mass.; Leon C. Guest, Jr., senior vice president of administration.

Columbia Cable & Electric Corp., Brooklyn, N. Y.—Richard F. Fagan, general sales manager.

Permacel, New Brunswick, N. J. —William J. Gross, vice president.

Oak Manufacturing Co., Crystal Lake, Ill. — Stewart Pfannstiehl, senior vice president; Eugene M. Keys, vice president, marketing.

Simplex Wire & Cable Co., Cambridge, Mass. — M. L. Anderson, manager of operations.

Furnas Electric Co., Batavia, Ill.—Mrs. W. C. Furnas, chairman of the board of directors and secretary; W. F. Lisman, president; D. F. Willcox, vice president; J. M. Dixon, treasurer.

Regional Appointments

NEW ENGLAND

Ramset Fastening System: Warren D. Sparks, district sales manager, in Connecticut, upper New York State and Rhode Island.

MIDDLE ATLANTIC

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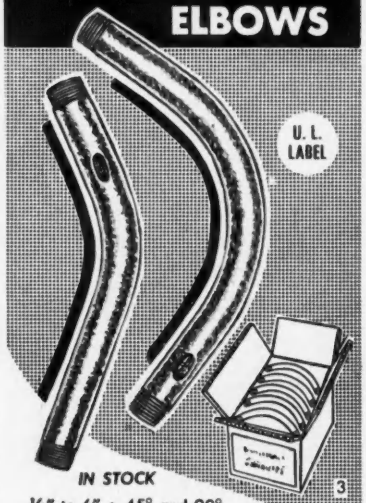

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FATHER AND SON contractor combination, Robert and Leon Kilian of Kilian Electric, Saint Michael, Minn., relax between sessions of Minnesota Electrical Assn. annual meeting in Minneapolis.

uel W. Rinn, manager, general industrial sales; John V. Rumble, manager, utility sales; Pittsburgh district; Industries Group.

Permacel: Maynard F. Lydiard, Jr., division sales manager for the mid-Atlantic area.

Clark Controller Co.: Irving Shapiro, sales representative, covering eastern Pennsylvania, southern New Jersey, Delaware and the eastern shore area of Maryland; American Electric Switch Div.

Electrical Fittings Corp.: Leonard Schaefer, eastern regional manager, headquarters in East Farmingdale.

Thomas Industries Inc.: Nelson R. Nauman, sales representative with headquarters in Pittsburgh, Pa.; Lighting Div.

Westinghouse Electric Corp.: Richard T. Butler, Brooklyn district sales manager with headquarters in Richmond Hill, N. Y.; Lamp Div.

Electronic Specialty Co.: S. Lloyd Moore, Jr., sales engineer in the Philadelphia area.

Ilg Electric Ventilating Co.: Gerald Leonard, sales engineer, headquarters in New York City.

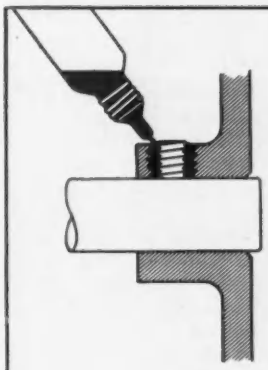
SOUTH ATLANTIC

Thomas Industries Inc.: Gerald B. Schulz, sales representative with headquarters in Atlanta, Ga.; Lighting Div.

Amplex Corp.: J. A. Witter, sales representative for western Pennsylvania and portions of West Virginia and Maryland.

Sun-Tron Corp.: C. H. Cloer & Associates, Atlanta, Ga., sales representative, covering Alabama, Florida, Georgia, South Carolina and Tennessee.

Electronic Specialty Co.: Richard C. Fruland, sales engineer as-



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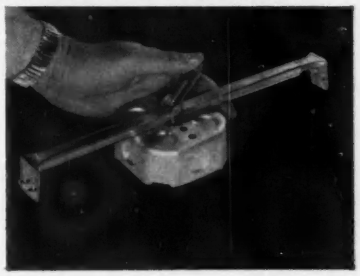

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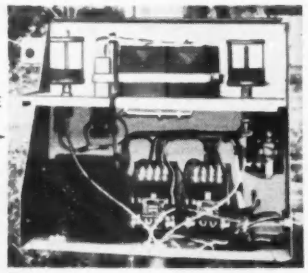

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EAST CENTRAL

Sun-Tron Corp.: K. E. Eggenspiller & Associates, Anchorage, Ky., sales representative covering Kentucky and southern third of Indiana.

Permacel: Raymond A. Rogers, regional sales manager for central United States headquartered in Chicago.

R. E. Dietz Co.: Perry and Barr Co., Nashville, Tenn., representative in the Southeast; Hazard Lighting Div.

Allis-Chalmers Mfg. Co.: Clare K. Tubbs, manager, industrial equipment division sales with headquarters in Cleveland; Industries Group.

Clevite Transistor: H. R. Bothe, regional manager, Midwest region with headquarters in Chicago.

Line Material Industries: Arden L. Greenwald, East Central region lighting engineer with headquarters in Cleveland covering parts of Michigan, Indiana, Kentucky, Pennsylvania and West Virginia.

WEST CENTRAL

Electronic Specialty Co.: Kenneth A. Young, field sales engineer, headquartered in Dallas.

Progress Mfg. Co.: William Brown Miller, senior salesman with headquarters in Dallas.

Thomas Industries Inc.: Gerald B. Schulz, sales representative in Dallas; Lighting Div.

WEST

G&W Electric Specialty Co.: John P. Bagoy & Associates, Anchorage, Alaska, sales representative.

Motorola Communications and Electronics, Inc.: Everett LeGette, regional sales manager in the western United States with headquarters in Denver.

Thomas Industries Inc.: Kenneth D. Cummings, South Pacific divisional sales manager with offices in Los Angeles; Moe Light Div.; Nicholas Condos, Southern Pacific general manager with offices in Los Angeles.

Sylvania Electric Products Inc.: C. A. Peterson Co., Los Angeles, Calif., lighting fixture agency for southern California.

Permacel: Thomas H. Gibson, Jr., Southern California division sales manager; Ralph W. Riggins, Northern Pacific sales manager.

Sun-Tron Corp.: South-West Sales Co., Phoenix, Ariz., sales representative for Arizona and the western portion of Texas.

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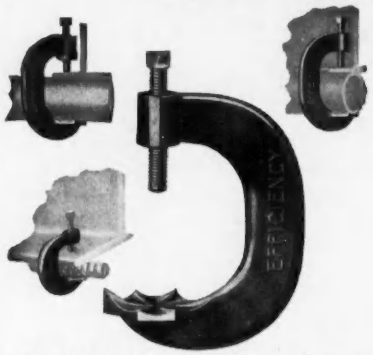

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ELECTRIC HEAT FOR HIGH SCHOOL

[FROM PAGE 99]

Power Distribution

Total connected load is 2155 kw. And 152 separate installations of space heating equipment account for 73% (1558 kw) of the total load. Other large loads include: water heating—273 kw; lighting—183 kw; cooking—92 kw; and miscellaneous—38 kw.

Power for this equipment is supplied by the utility at 4160Y/2400 volts, 4-wire. Pad-mounted, a 750-kva transformer steps down this supply voltage to a 480Y/277-volt grounded, 4-wire distribution system. From the primary transformer, 2500-amp busbars carry the secondary voltage to a main distribution panel protected by a 3000-amp, 3-pole air circuit breaker set at 2500 amps.

At the main distribution panel, molded-case circuit breakers, rated 40,000 amps RMS IC at 480 volts, protect feeders which supply eleven branch-circuit panels. Branch-circuit panels provide 480 volts, 3-phase and 277 volts, single phase to heating equipment. In addition, 277 volts for fluorescent lighting is derived from these panels. Ten distribution transformers supply miscellaneous 120-volt service.

Air circuit breakers at the branch-circuit panels provide disconnecting means for space heating equipment in addition to circuit breakers or switches mounted within or near each heating unit.

All feeders and most of the branch circuits are run underfloor in conduit. Some branch-circuit conduit runs utilize the false ceiling space.

Other electrical features of this all-electric school include complete electric kitchen facilities; modern fire-alarm system; public-address system and stage lighting; a sophisticated clock and program system, which includes facilities for sports announcing in the gymnasium and for special programming in the auditorium and in the cafeteria. Provisions for a TV system are also installed.

The electrical contractor was Lyons Electric, Alpha, N. J. Edwin F. Jones, Plainfield, N. J. was the consulting engineer, and the architect was Seth Ely, Jr., Dover, N. J.

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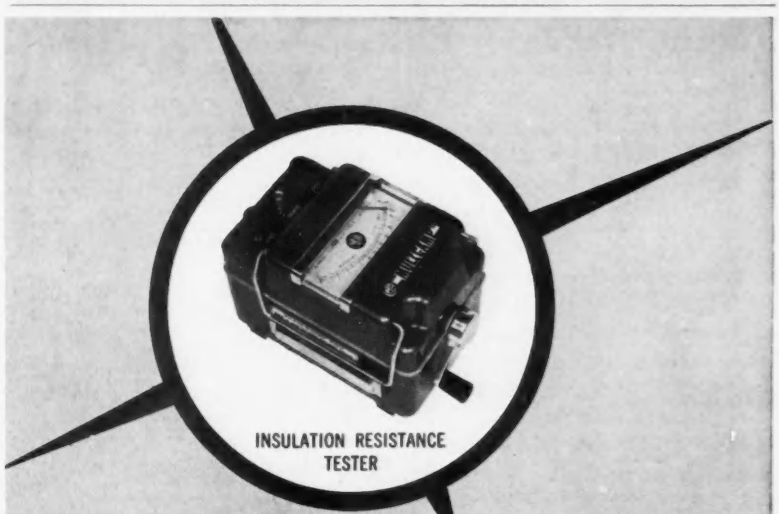

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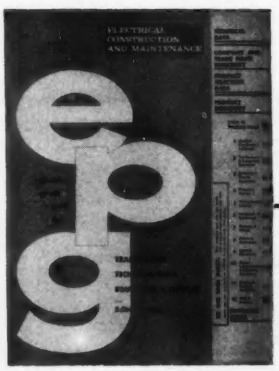

• These manufacturers advertised their products in the ELECTRICAL PRODUCTS GUIDE ISSUE

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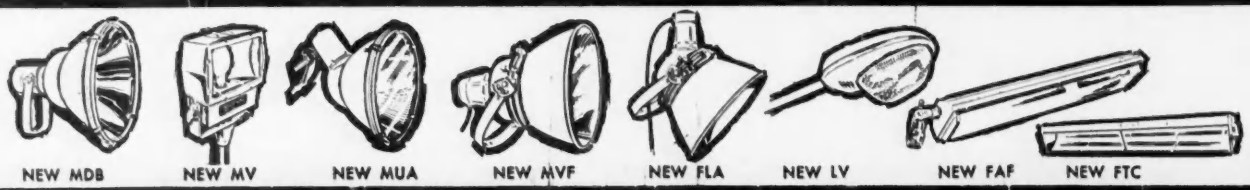

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